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Electrical World

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Need of Publicity

PUBLICITY is a very potent force for good provided it is wholesomely and properly applied and withal at an appropriate time. In industrial and in corporate life just as in the workaday world

> There is a tide in the affairs of men
> Which, taken at the flood, leads on to fortune;
> Omitted, all the voyage of their life
> Is bound in shallows and in miseries.
> On such a full sea are we now afloat,
> And we must take the current when it serves
> Or lose our ventures.

But no amount of publicty will avail anything nor can any argument or excuse atone for inferiority of service or merchandise, or for pledges broken or obligations slighted, or for costs which are excessive. The cause must be just and worthy if publicity is to be of any service to it at all.

Now, there is much about the electric utility business, and particularly about the manifold uses of electricity, that the public does not know and on which it must have enlightenment if maximum use of electricity with mutual advantage is to result. There is not a widespread public knowledge of the fact that the same wonderful, flexible power which can propel the most ponderous train swiftly across the steepest mountain grade can also be used to manipulate the finest needle or the most delicate instrument. The consciousness that electricity has contributed incalculably to modern civilization and that its application will solve many of our most pressing industrial and domestic problems is not entirely developed. Likewise, the general public fails to realize the difficulties under which service is rendered and the injustice of a legally stipulated and almost immovable price. Only when these questions are brought home intimately can a sympathetic hearing be obtained.

Of what immense value would enlightened public opinion have been to the street railways of the country in their adversity if they had given information regarding their affairs to the public in the last decade! Their function is to carry passengers, but they have also borne other semi-public burdens, such as paving, removal of snow, etc. There can, however, be no upright opinion without knowledge, and this the railway companies were too late in imparting. Is it not owing to the publicity campaigns of the telephone systems, as well as to their good service under corporate control, that the present policy of government ownership and control by contrast appear so obnoxious? And is there not a lesson here for the electric utilities? Indeed, the National Electric Light Association can well afford to see to it that the problems of the electric utilities are so spread before the public that he who runs may read, and that the possibilities inherent in the application of electricity are set forth so that the housewife, merchant, manufacturer, and the nation as a whole, will instinctively turn to electricity for relief. While it is most fortunate that electricity is its own best advertiser, it is also most unfortunate that neither the public nor the industrial world has an adequate comprehension of the full possibilities of its application. Here is work to which the National Electric Light Association can well apply itself.

But this is only one phase of the problem, and, important as it is, there are other problems within the public utility field itself awaiting solution which involve the central station and other branches of the industry on which the National Electric Light Association can also concentrate its energies and resources in the public interest. These have to do with the questions of standardization of service and equipment, uniformity in commission regulations and rulings, ordinances and franchises, valuation, rates and the utilization of natural resources. As the authority in such matters, the National Electric Light Association has an obligation to acquaint the public with the facts. There can be no doubt about the need of more general knowledge and the desirability of undertaking the work of imparting it at once. The need is plain, and we believe that the mere statement of it will quicken action toward the desired end.

Results count for more than costs. Delegates to the National Electric Light Association convention at Atlantic City, beginning on May 19, will learn what post-war problems mean in a good many localities. The expense will yield a return that by comparison will make the return allowed by commissions look seasick.

The Victory Loan

SOME of those who went into the war have paid the full cost. No more is asked, can be asked, of them. They have given with willing heart that freedom might live. The name and fame of America's part in the war are inseparable from their sacrifice. Many others did all that they could do in different ways that were vitally necessary, but they were not called on to offer their lives in danger on the battlefield. It is a great obligation which we face toward these who took the risks at the front. This obligation is brought to mind by the poster printed by the publisher of the ELECTRICAL WORLD and distributed with this issue. Heroes who fought and died, heroes who fought and lived, did their part to put the victory into "Victory Liberty Loan." They did not lend, they gave. It is up to the rest of us to lend the money so that Uncle Sam can pay the bills. The hardest work of the war is done, the road is clearer ahead, the fifth loan will finish the job.

Distribution in Industrial Plants

THE most frequent trouble with electrical industrial installations is that they just grow without a properly coherent plan of operations. A few motors go in, then a few more, and by the time the work is complete it is tangled and as a whole inefficient. F. L. Leurey exhibits to our readers an excellent example of quite the other thing—the evolution of a well planned and executed equipment with an eye to results in the larger aspect and to ordered simplicity and economy. The equipment considered is that of a big sugar refinery with about 400 motors devoted to a wide variety of purposes and aggregating some 6000 hp. The total load factor is, however, somewhat favorable, since the plant runs twenty-four hours per day and only locally displays unusual load changes.

The power plant here is for 480-volt, three-phase distribution, in three units, with fourteen feeder circuits. The distribution was almost necessarily in conduits, and the feeder system was laid out on the basis of three 500,000-circ.mil cables per conduit. Uniformity of loading was secured by adroit routing of these main feeders. To continue the orderly progress of affairs standard steel switchboards were designed for the subdistribution with standard conduits and fittings, so that, however crowded with machinery the space may be, the boards are safe and easy to handle. To give opportunity for the necessary changes in machinery the whole working space was gridironed with sub-feeders to serve as always available sources of power. The standard subfeeder is of three No. 1 wires and is generally run beneath the floor slab so that the control may be reached by a short riser. Like the switchboards and feeders, the starting equipment is standardized in a few simple forms. Altogether, a study of this particular industrial equipment reveals a singularly orderly and effective development of an apparently intricate system from simple elements simply combined.

Was the war worth the price? Are the boys who come back worth bothering over? You don't hear pessimistic remarks on the real issue. We may sidestep on the minor questions, but on the great big issue of the war won for the sake of a decent world the vote is about unanimous. And the true meaning of it is starting new life in every industry.

Dean Cooley's Vision of the Engineer

THREE things stand forth in the views of Dean Cooley of Michigan on the field of the American engineer. These, it will be seen from the article printed elsewhere, are his potential service as a link between labor and capital, his qualifications to enter public life, and the desirability of broadening and humanizing his college education. The growing discussion of the subject by technical men and others leads, indeed, pretty generally to this tripartite conclusion. It is an attractive vision. First, we have the American engineer in the shop, inspiring and instructing the workmen under him, understanding them, their needs and their ambitions, and proving the ideal mediator between them and their employers. In taking such a part the engineer, rather than the capitalist, becomes the veritable captain of industry, and this is as it should be. Second, we have the American engineer in the legislative halls and the executive chair—perhaps even in the White House, and it must not be forgotten that if only one engineer has ever risen to be the President, he was the first and greatest. In public office, as has often been contended, the engineer's analytical mind, reasoned processes and gift of foresight should enable him to serve his community and the nation with distinction and success. Third, we have the American engineer as an element in the cultural forces of the country—not afraid to make an occasional excursion into the realms of literature, art or music, not ignorant of the classics of his mother tongue nor yet obliged to sit mute and uncomprehending in international councils where the proceedings are not in English—taking his place, with unstarved imagination, among other men of catholic development.

Only the occasional man, of course, can combine in himself the attributes of the practical worker, the technician, the statesman and the all-around scholar. Him we call great. But all engineers, graduates and students alike, can strive for fuller accomplishment both in their trade and in their citizenship, and in avoiding the whirlpool of scattered energy can steer clear also of the rock of specialization too narrow and intense.

New England telephone workers were wrong in resorting to strike, because striking is inadmissible in a public utility. The government authorities, however, were wrong in relying altogether on public condemnation of the strike. They failed to get public support because their service is faultly and they were poorly advised in refusing to correct just causes of grievance on the part of employees.

Some Uses of Spot Welding

ELECTRIC welding as a substitute for riveting has been gradually coming into use for some years, and the rush work done during the war in shipbuilding and similar classes of metal working has demonstrated the usefulness of the new process. G. A. Hughes and R. H. Pool in a very recent issue gave a clear and simple account of the several types of spot welding which have come into use for various work which earlier depended entirely upon riveting. Both arc welding and resistance welding are successfully applied in this way. In the former process it is usual to punch one of the sheets to be joined, as if for rivets, lap it on a plain sheet, and then bring the arc welder to work at the hole, welding in a solid plug to serve as a rivet. It is a quick and comparatively cheap process, not yet fully standardized and lacking some information as to the permissible size of spots and strength of the complete weld, yet very promising of good economic results. Spot welding with the resistance process brings somewhat heavy pressure at the point of contact with the electrodes and actually melts the work together at this particular point. The contact electrodes are of copper, and one of the outstanding difficulties of the process is the limitation to the pressure which can be applied to these relatively soft electrodes in forming a weld. Inasmuch as the strength of the weld depends on the final squeeze when metals are being melted together and the necessary force of this bears some relation to the thickness of plate, there is a limitation on thickness thus imposed. Just what the value of this limit may be remains undetermined. Work up to a thickness of ¾ inch (19 mm.) has been handled by the authors with special machines, but the resistance process is much easier on the thinner plates.

There seems little doubt that electric spot welding is likely to be used to a very large extent to supplant ordinary riveting for many purposes. The important thing is to make a neat and tight joint, and this can be made quickly and cheaply by the welding process with sufficient strength for, certainly, the majority of purposes. It is likely that in the long run in such work as shipbuilding arc welding, resistance welding and riveting will all be used freely, each where the particular circumstances of the work give it the advantage. Welding as compared with riveting is quick, cheap and noiseless, and it is sure, we think, to find steadily increasing application. It is one of the interesting instances in which an old plan worked out in considerable detail a good twenty years ago has invaded under new economic conditions a wide field in which its early progress was but slow.

Charges that money might have been more efficiently expended by the government in the conduct of the war form a poor excuse for indifference toward the Victory Liberty Loan. With all her blunders and wastefulness, America came through gloriously, and shall we leave it to others to set the seal of financial indorsement upon our common achievement?

A Striking Case of Interconnection

THE union of neighboring transmission systems into a coherent network, pooling steam and hydraulic plants for common usage, is now so frequent as hardly to call for comment. Now and then, however, operating conditions arise which involve unusual features of practice well worthy of attention. Such an instance is found in the California scheme of interconnection described in our columns this week by L. J. Moore. The case concerned is the physical union of three important plants, those of the Southern California Edison Company, the San Joaquin Light & Power Corporation and the Mount Whitney Power & Electric Company. The first named has a group of hydraulic and steam plants in the Los Angeles territory and three big water plants far across the mountains, one on Kern River and two others on Big Creek; the second group consists of nine hydroelectric plants in the central California region with a couple of reserve steam stations, while the third operates water plants on the Kaweah and Tule Rivers and also a 5000-kw. steam reserve. An unusual feature of the situation is that the Edison plant operates at 50 cycles, the others at 60 cycles. There is one considerable reservoir on the San Joaquin system and another reinforcing the Big Creek plants. As all the generating stations concerned are on the same or closely similar watersheds, the need of storage or steam is imperative.

The first step toward mutual interconnection was taken two years ago to help out the Mount Whitney Company. A long 30,000-volt link was built, and one of the Kern River generating sets was speeded up to 60 cycles and cut in on the Mount Whitney connection. A little later the transmission was raised to 60,000 volts and tied in en route with the San Joaquin system. Thus as many of the four machines in the Edison Kern River plant No. 1 as are needed are raised to 60 cycles and put on the joint line. Finally, a few months ago a 5000-kw. frequency changer was tied in to transfer moderate loads without speeding up or slowing the generators and to facilitate the adjustment of power factor and voltage. The interconnection seems to work out admirably in practice, especially since the diversity factor is a rather favorable one, and what is more, it is possible to furnish power at times of short water from the most economical of the available steam plants. The Mount Whitney steam reserve is the least desirable on the score of cost of production, and at present it pays to replace its output from the Redondo or Long Beach steam plants or even from the distant Bakersfield station, which burns oil and natural gas. It is found that in changing the frequency by varying generator speeds there is some variation in prime-mover efficiency rather favorable to the lower periodicity, but this method of interchange involves no particular difficulties and the whole scheme of interconnection works out advantageously. The case is a rather extreme one, for the distances involved are long and the separate systems extensive, yet the interchange is a source of substantial saving and great convenience at times of scant water.

The stability shown by the central-station industry during the past five months is a basis for indestructible optimism as we look toward the future of electrical service. Could any better test have been devised of the adaptability of the industry to meet changing conditions?

The Electrification of an Army Base

THE army supply base at Boston, designed as a terminal and shipping point for general supply service, is a remarkable example of organization for rapid and efficient service in which electricity plays a peculiarly important part. The base, which is directly on the water front, has a working area of somewhat more than 40 acres (16 hectares) and pier facilities for accommodating simultaneously ten of the standard vessels of the Emergency Fleet Corporation. The main storehouse, of reinforced concrete, eight stories high, has about 35 acres (14 hectares) of floor space and is connected with an immense two-story wharf shed of which the upper story is on the level of the third floor of the storehouse.

To facilitate quick and efficient service it was determined to equip the whole terminal electrically for freight handling and general use. To this end the buildings are fitted with forty-six electric freight elevators, six automatic passenger elevators, twenty-four electric winches and four cranes. Besides the outfit for the buildings there are forty small storage-battery tractors and 600 trailers. It is reckoned that 200 carloads can be unloaded in ten hours, while the wharf shed cranes can load an 8000-ton vessel in less than sixty hours' working time. The freight elevator equipment consists of four 5-ton units in each of the six independent sections into which the storehouse is divided.

The plant is operated by a substation initially of 4500-kva. rating fed by duplicate 13,800-volt cables from the Edison station. The general distribution is at 2300 volts stepped down to 110 or 220 for the motor and lighting service. During the building of the plant an 800-kva. temporary substation was installed to furnish power during the construction period. This station, it is interesting to note, was put up complete in less than thirty days from the start, together with about 14 miles (23 km.) of line wire with the necessary poles, 1000 outlets for interior wiring of temporary structures, thirty motors and twenty transformers—a rush job of highly efficient character.

Synchronous Motor Characteristics—I

The Heyland Diagram for the Induction Motor Is Applied to Synchronous Motors with Squirrel-Cage Windings in Order to Investigate Starting and Pull-in Torques—Brass and Copper Compared for Rotor Bars

BY THEO. SCHOU
Consulting Electrical Engineer, Electric Machinery Company

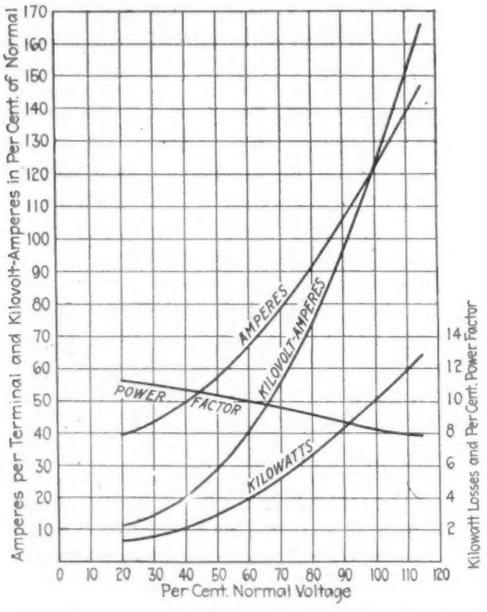
THE polyphase synchronous motor starts, and behaves during the starting period, like an ordinary induction motor. An induction motor, however, even at no load, can never reach synchronous speed, whereas a synchronous motor of the defined pole construction will draw itself into synchronous speed, and even carry considerable load, before the field excitation is applied. In the first of two articles it is the purpose of the author to show how the Heyland diagram may be used to investigate the starting characteristics of synchronous motors and to apply the method to a comparison between motors with copper and brass squirrel-cage windings in regard to starting performance. In the second paper a compound squirrel-cage winding will be discussed, showing an excellent device for obtaining good starting torque as well as high pull-in torque.

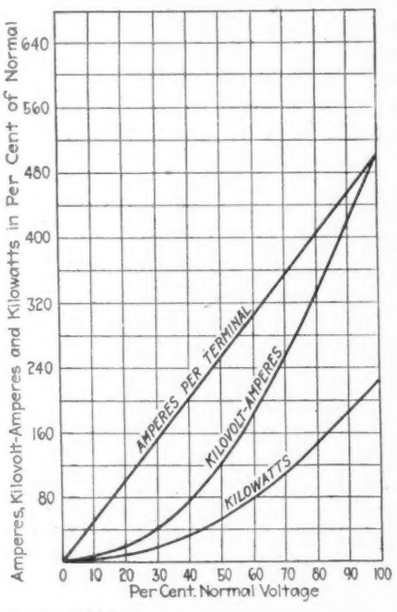
The fact that the synchronous motor may be brought into step with the line without field excitation is mainly due to the defined pole construction, which offers paths of varying reluctance to the alternating flux, depending upon the position of the field poles with reference to the alternating flux path. If the magnetic circuit of the field poles is in line with the alternating-current flux path, then the reluctance evidently is a minimum. At any other position of the field poles with reference to the alternating flux the reluctance will increase, and it will become a maximum when the alternating flux path is in line with the center line between poles or goes through the interpolar space.

The alternating flux strength, however, depends upon the alternating ampere turns per pole, and as the turns remain constant, the armature current drawn from the line will vary in value as the reluctance varies. As the motor approaches synchronous speed the flux path will take and maintain the path of minimum reluctance and the motor will be in step and drawing a steady current.

The force with which the motor is kept in step without field excitation, or the load the motor will carry under this condition of operation before falling out of step, may be from 25 to 50 per cent of its normal load, varying with the design.

The starting characteristics and design features in connection with the same may most conveniently be discussed by applying the plain Heyland circle diagram. The complete construction of this diagram requires knowledge only as to the resistance of the armature winding and kva. input and power factor at normal voltage, (1) when motor is running idle at zero per cent slip, and (2) when standing still or with locked rotor at 100 per cent slip. The construction is similar to an induction motor diagram, but proportions are somewhat different. Although this construction is well known, a brief outline is deemed advisable.





FIGS. 1 AND 2—RUNNING AND LOCKED SATURATION TESTS OF 100-HP. SYNCHRONOUS MOTOR
100 hp., 2200 volts, 106 amp., three-phase, 60 cycles, 600 r.p.m.

Working from the test results, the kva. input and power factor of the motor when running at zero per cent slip, normal voltage, is obtained from the running saturation test (Fig. 1). The kva. input and power factor of the motor when standing still or "running at 100 per cent slip" is obtained from the locked saturation test (Fig 2). Amperes and kilowatt losses are taken at lower voltage so as not to draw a prohibitively large current, and the curves are extended to normal voltage by calculation, as the amperes increase directly in proportion to the applied voltage and the kilowatt losses with the square of the applied voltage.

Now, referring to the circle diagram, Fig. 3, it should first be noted that this diagram is a general one and does not necessarily correspond with the values as obtained from Fig. 1 and Fig. 2; furthermore, it combines two diagrams in one, showing the effect of using bars of copper and bars of brass in the squirrel-cage winding. As everything else has remained the same, the maximum torque, although remaining the same in both cases, will occur at different slips. For construction of the diagram it will be found practical and more conveni-

ent for discussion to use kva. instead of current vectors and also to plot the kva. vectors in per cent of normal, instead of using actual values. For the sake of convenience, a power-factor circle is drawn in in the diagram (Fig. 3). The magnetizing kva. found either by calculation or from the running saturation test, is laid off according to magnitude and power factor, and is represented by the vector *O-R*. This magnetizing kva., as per diagram, is approximately 132 per cent of the normal kva at 8.5 per cent power factor; its

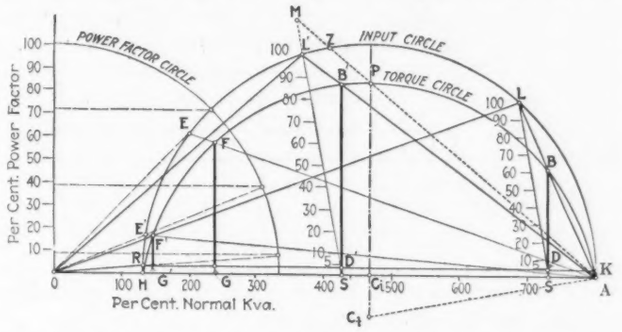


FIG. 3—INDUCTION MOTOR DIAGRAM APPLIED TO SYNCHRONOUS MOTOR

wattless component is *O-H* and its watt component *H-R*. We have now located one point *R* on the kva. input circle, which corresponds to no load, zero per cent slip.

Another point, *L*, is obtained by laying off according to magnitude and power factor the kva. at standstill (100 per cent slip), found either by calculation or from the locked saturation test. Vector *O-L* represents kva. drawn from line, with rotor equipped with copper bars in the squirrel-cage winding, at standstill and with normal voltage applied. Referring to diagram, it is laid off as 730 per cent of normal kva. at 34.5 per cent power factor. The input circle is then drawn through *R* and *L*.

The torque circle is found as follows: When the motor is standing still, or locked, with voltage applied at its terminals, no work apparently is done, although torque is exerted. The output of the motor in this case is transformed into heat, and in the diagram vector *L-A* represents the stator and rotor copper losses. Now, since the starting torque is proportional to the rotor losses, we can find the torque by deducting the stator I^2R loss, which is known when the current and resistance per phase are known.

In the diagram vector *L-B* represents the stator I^2R loss, and vector *B-K* the rotor I^2R loss. The torque circle, therefore, must pass through the point *B*. It also must pass through the points *H* and *A*, where the torque is zero. The center C_t of the torque circle is at the point where the vertical line C_t-*P* is intersected by the perpendicular bisector of the line joining points *H* and *B*. If a line is drawn through the point *L* at right angle to *A*-C_t, we obtain the slip line *L-S*, which if divided into 100 equal parts, as shown, will give the operating characteristics of the synchronous motor, running as induction motor, at any slip from zero to 100 per cent. The starting torque of the synchronous motor equipped with copper bars in the squirrel-cage winding can now be found directly from the diagram in terms of per cent normal kilowatt rating by scaling the vertical or kilowatt component of the vector *A-B*. The starting torque proper is represented by the vector *B-D*, which in this case is approximately 146 per cent of normal.

In reading off the torque at any other slip the torque will be the vertical distance from the torque circle to the line *R-K* drawn through point *R* parallel to the base line *O-A*.

Equipped with brass bars in the squirrel-cage winding, the kva. input of the motor at standstill is represented by the vector *O-L'*, and as everything except the rotor resistance has remained the same, the point *L'* will be located on the input circle as found for motor equipped with copper bars in the squirrel-cage winding. Vector *L'-B'* represents for this condition the armature I^2R loss, vector *B'-A* the rotor I^2R loss, and vector *B'-D'* the starting torque. Scaled from the diagram, the starting kva. of the motor equipped with brass bars in the squirrel-cage winding is approximately 487 per cent of normal, the power factor 66 per cent and the starting torque 266 per cent of normal. As no current is flowing in the squirrel-cage winding at zero per cent slip, the magnetizing current, or the kva. input at no load, remains the same and is independent of the material of the squirrel-cage winding.

In discussing the magnetizing current or the kva. input at no load, it should be noted that this is far larger than should be expected from induction-motor practice. The power factor is also much lower. This is due to the fact that the air gap of a synchronous motor is, and must be, much larger than that of the corresponding induction motor.

As pointed out by the writer in the ELECTRICAL WORLD of April 6, 1918, in his article on "Improving Synchronous Motor-Starting Features," the air gap of synchronous motors is limited from electrical, that of the induction motors from mechanical, reasons. In Fig. 4 the approximate values of air gap and magnetizing current are plotted for a 100-hp., 60-cycle synchronous and induction motor at different speeds. The curves are self-explanatory and bring out clearly the statement made above. The power factor of a synchronous motor when running as an induction motor is very low, owing

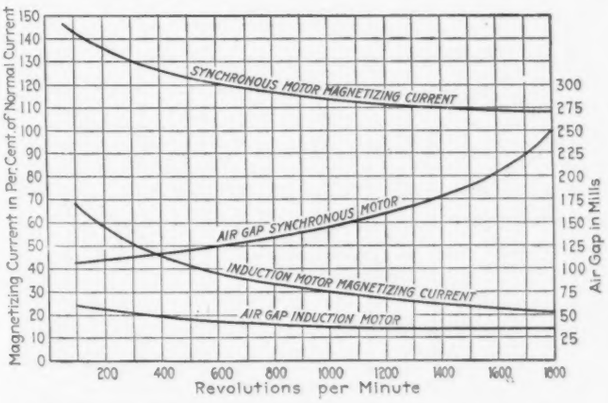

SYNCHRONOUS MOTOR MAGNETIZING CURRENT
AIR GAP SYNCHRONOUS MOTOR
INDUCTION MOTOR MAGNETIZING CURRENT
AIR GAP INDUCTION MOTOR
Magnetizing Current in Per Cent of Normal Current
Air Gap in Mils
Revolutions per Minute

FIG. 4—AIR-GAP REQUIREMENTS FOR SYNCHRONOUS AND INDUCTION MOTORS

to the large wattless component of the magnetizing kva. (See Fig. 1.)

If test data, such as no-load and short-circuit saturation tests, are available, the magnetizing current of a synchronous motor may be found as follows: Neglecting the saturation of the magnetic circuit, a synchronous motor running at any voltage, at synchronous speed and without field excitation, will draw a current from line approximately equal to the short-circuit current when run as a generator with fie'd excitation corre-

sponding to above-mentioned voltage on open circuit. (A detailed explanation of this will be found in the ELECTRICAL WORLD of Feb. 19, 1916, embodied in an article by the writer entitled "The Excitation of Synchronous Machines.") Referring to Fig. 5 and applying the above rule, we obtain a magnetizing current for this motor when running at normal voltage equal to 125 per cent of normal current. The running saturation test of this motor is reproduced in Fig. 1 and from this the actual magnetizing current is found to be 123 per cent of normal current, which checks very closely with the value obtained from the above-mentioned method.

COMPARISON OF COPPER AND BRASS FOR ROTOR BARS

With good starting characteristics we obtain high torque with low kva. input. A glance at the diagram (Fig. 3) shows that in order to achieve this we must keep the magnetizing current and the armature I^2R loss low and the rotor resistance high. As pointed out before, the magnetizing current or the motor kva. input at no load is limited from electrical reasons. The armature I^2R loss is also more or less limited both from electrical and economical reasons. The rotor I^2R loss, however, may be varied at will over a wide range. It is most important to consider in this respect that with synchronous motors we are not limited by running characteristics as would be the case with induction motors. With synchronous motors the squirrel-cage winding is used only during the starting period and not under running conditions. The slip and lagging power factor inherent with induction motors are, of course, eliminated in synchronous motors.

Referring to Fig. 3, we note that with copper bars in the squirrel-cage winding the maximum torque is

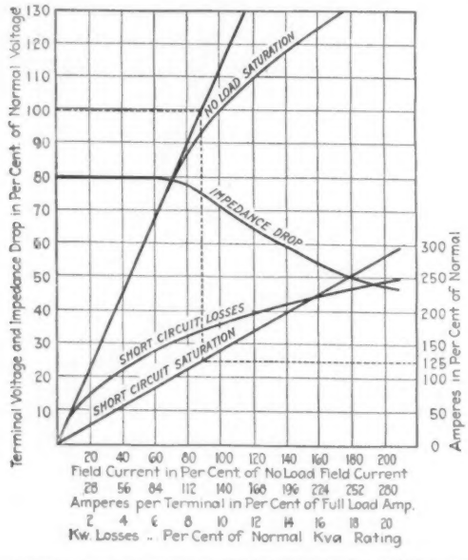

Terminal Voltage and Impedance Drop in Per Cent of Normal Voltage
NO LOAD SATURATION
IMPEDANCE DROP
SHORT CIRCUIT LOSSES
SHORT CIRCUIT SATURATION
Amperes in Per Cent of Normal
Field Current in Per Cent of No Load Field Current
Amperes per Terminal in Per Cent of Full Load Amp.
Kw. Losses .. Per Cent of Normal Kva Rating

FIG. 5—METHOD OF DERIVING MAGNETIZING CURRENT; REFERS TO MOTOR DESCRIBED IN FIGS. 1 AND 2

exerted at 27 per cent slip. The maximum torque, the kva. input and the slip at which maximum torque occurs are found from the diagram by drawing a line through the point *A* and the point *P*, which represents the crest value of the torque circle. The slip is found by the intersection of this line with the slip line. The kva. input is found by drawing the line *O-Z*, which represents the kva. vector.

In case of brass bars in the squirrel-cage winding it is found that the maximum torque occurs at a slip of more than 100 per cent or at a negative slip of 25 per cent. (This slip, —25, is found by the intersection of the line *A-P* with the slip line *L'-S'*, or at point *M*.) It is obvious, therefore, that a certain critical rotor resistance exists where maximum torque will be exerted at standstill or at 100 per cent slip. This critical re-

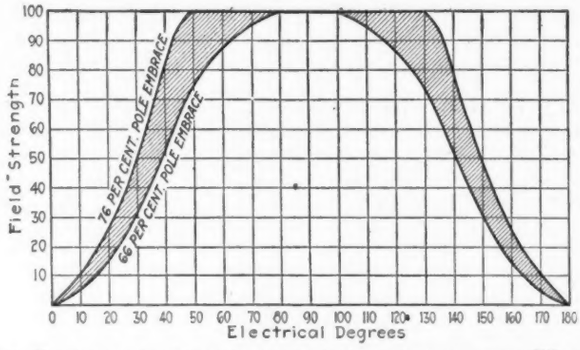


FIG. 6—FIELD FORMS OF SYNCHRONOUS MOTORS WITH 76 AND 66 PER CENT POLE EMBRACE. FIG. 6 REFERS TO MOTOR DESCRIBED IN FIGS. 1 AND 2

sistance of the rotor winding has for any motor design a definite value which approximately may be found by the equation:

$$R_c = \sqrt{R_s^2 + (X_s^2 + X_r^2)}$$

Where:

R_c = critical rotor resistance in ohms per phase, reduced to equivalent primary resistance.

R_s = stator resistance in ohms per phase.

X_s = stator reactance in ohms per phase.

X_r = rotor reactance in ohms per phase, reduced to equivalent primary reactance.

If we now would investigate the kva. input, torque and power factor at 10 per cent slip of the rotor equipped with copper and brass bars in the squirrel-cage winding, we find from diagram:

Rotor Bars	Per Cent. Kva.	Per Cent. Normal Torque	Per Cent. Power Factor	Per Cent. Slip
Copper	286	180	71.5	10
Brass	147	43	38.5	10

We see from this that we can vary the starting characteristics very materially by merely changing the material of the squirrel-cage winding.

AMERICA threw the world into a daring maze of possibilities by its entrance into this war upon lines more idealistic than any other national venture in history. And in doing this we challenged the world to a contest for supremacy, not upon the field of battle, but in the much larger field of intellectual, moral and social leadership. Whether we can make good before the world depends upon our willingness and our ability to see the problems that we must meet and our will to meet them forehandedly. For clearly our right to world leadership in the new day is not to be measured by the number of men who have gone to France or the things they have done, but by the use we now and from this time forward make of the freedom we have secured for ourselves and others.—*Secretary of the Interior Franklin K. Lane.*

Modern Bus and Switch Structures—II

Increase in Size of Generating Units and of the Number Operated in Parallel Has Necessitated Accommodation of New Types of Circuit Breakers and Reliable Support of Buses —Masonry, Material, Compartment Doors and General Arrangement

BY C. D. GRAY AND M. M. SAMUELS
J. G. White Engineering Corporation

In last week's issue the authors pointed out that, owing to the coming of huge turbo-generators and the operation of these units as well as plants in parallel, more careful consideration of bus and switch structure design is required than formerly. Switches of larger rating have to be accommodated, space must not be cramped, stresses produced by short circuits must be withstood without damage, and disconnecting switches should be preferably operated by a single handle. This installment of the article will be devoted to the consideration of supporting busbars, providing space for current and voltage transformers, compartment material and doors, signals, grounding, conduit and general arrangement.

WHEREAS in small busbar installations it is only necessary to consider the insulating value of the supports, the majority on the market being of ample mechanical strength to withstand the short-circuit stresses of a comparatively small installation, it is important to investigate closely the tensile strength and cantilever strength of a busbar support which is intended to withstand the mechanical stresses caused by a short circuit of 500,000 kva. or over. The distance between phases and the spacings of busbar supports on each individual run of bars will be determined to a great extent by the mechanical strength of the available insulators. The method of determining short-circuit currents and mechanical stresses caused by them was thoroughly discussed by I. W. Gross in a paper presented at the one hundred and third meeting of the American Institute of Electrical Engineers, New York, on Jan. 8, 1915, and very little has been added on this subject in the engineering literature since the publication of that paper. Porcelain factories have of late been making a thorough study of the mechanical qualities of porcelain, and particularly of the mechanical strength of joints between porcelain and metal, with the result that busbar supports of sufficient mechanical strength can now be

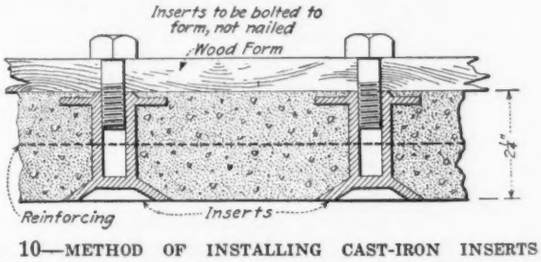


FIG. 10—METHOD OF INSTALLING CAST-IRON INSERTS IN CONCRETE SLAB FOR MOUNTING BUSBAR SUPPORTS

obtained at a reasonable cost. However, even with the good designs of bus supports which are now available, it is important to test every individual insulator after the various clamps have been mounted on it not only for flashover but also for mechanical strength before installing it. But even if an insulator withstands mechanical test in the laboratory, there is no guarantee that it will stand up under actual short circuit, since the time element of a short circuit, and therefore the exact nature of the impulse which may be caused by it, is a quantity which cannot be predetermined. Short-circuit conditions will have to undergo a considerable amount of additional research before the nature of an impulse can be predetermined with a reasonable amount of accuracy, and in the meantime it is advisable to be very conservative in the selection of busbar supports for heavy duty.

In this connection it may be mentioned that the back-connected busbar supports used in the structures shown in Figs. 6, 7, 9 and 15* not only give a very simple and

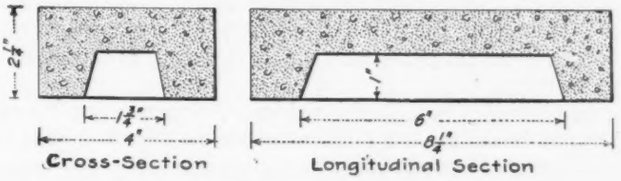


FIG. 11—CONCRETE BRICK FOR BUS STRUCTURES

accessible bus arrangement but also add a great deal of mechanical strength to the bus system. This type of bus support consists of a strong porcelain bushing which may be either cemented or clamped in the brick wall. A solid copper rod runs through the full length of the bushings and is clamped on each end. To the end of the rod which projects into the bus compartment or shelf is attached a suitable clamp of proper carrying capacity and contact surface for holding the busbar. The other end of the rod is equipped either with a similar clamp in the case of high current or merely with contact nuts in the case of low current for accommodating the connection to the disconnecting switch or other apparatus. Where busbar supports are attached to a concrete slab it is not advisable to set bolts in the slab for this purpose, since with such an arrangegement it would be necessary to lift the whole bus whenever it was wished to remove an insulator having a base cemented to it. It is much preferable to set metal inserts in the slab as shown in Fig. 10. With this arrangement it is possible to remove the bolts and slide the insulator out from underneath the bus without disturbing the bus itself. Whenever possible the base as well as the top fitting should be clamped, not cemented, to the porcelain.

Current Transformers and Potential Transformers.—In the preliminary design of a bus structure and of space requirements for it the current and potential transformers are often left out of consideration, and great difficulty is experienced later in trying to find necessary space and a good wiring arrangement for them. Since usually no more space is allowed for a bus structure than is absolutely necessary, this condition will result in crowding of other apparatus and the installation of auxiliary compartments in unusual places and will in general lead to awkward-looking structures. It is therefore very essential to consider all the current and

*Figs. 6, 7 and 9 in last issue.

potential transformers when making the first design of the structure.

Masonry Material.—All who have had considerable experience in the design, erection and maintenance of bus structures now generally agree that reinforced concrete is not the proper material for bus-structure walls, and that brick is much more suitable for the purpose. The discussion about "brick versus concrete" may now be considered as having been generally decided in favor of brick. The best obtainable pressed brick should be used for the purpose, and only experienced labor should be employed, since a small additional expenditure on good material and labor will be only a small proportion of the total cost of the structure. Whenever it is necessary to set small bolts or cast-iron inserts near the end of a brick wall, it is advisable to set these bolts or inserts in small concrete blocks which can be made up to conform to the brick dimensions and which can then be set into the brick compartments. Thus the necessity of cutting and chipping many bricks can be avoided without affecting the good appearance of a brick structure. However, this suggestion does not refer to main bolts for mounting the circuit breaker, the mechanism or other important parts, and the briquette idea should not be overdone.

Whenever it is difficult to obtain the proper quality of pressed brick, cement brick can be recommended. Various forms of cement brick have been used on many occasions with excellent results. One of the forms was described in the ELECTRICAL WORLD of Nov. 23, 1918, by E. B. Meyer. Another form of cement brick, which was used by the J. G. White Engineering Corporation in a recent installation, is shown in Fig. 11.

For horizontal shelves or barriers white sandstone slabs have been used with very good results. Wherever sandstone is not available reinforced concrete slabs are generally used, as described in a previous article.† Natural soapstone or some of the artificial stones are also used.

No doubt sandstone will be tried out in the near future for bus-structure walls, since with the methods now in use at the quarries for sawing sandstone there does not seem to be any particular reason against the construction of a whole bus and switch structure from sandstone, provided the cost is not excessive. This depends largely on the freight cost.

Compartment Doors.—The doors of the compartments containing the oil circuit breaker proper must be arranged for suspension, so that they can swing out in case of an accumulation of gases in the compartment. Such doors have been made traditionally of asbestos wood and in some cases of wire glass. But there is no objection whatever to making them of light steel plate with small angle or channel frames.

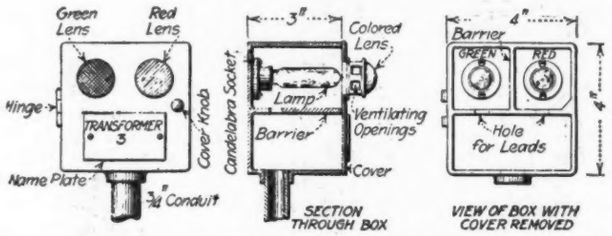
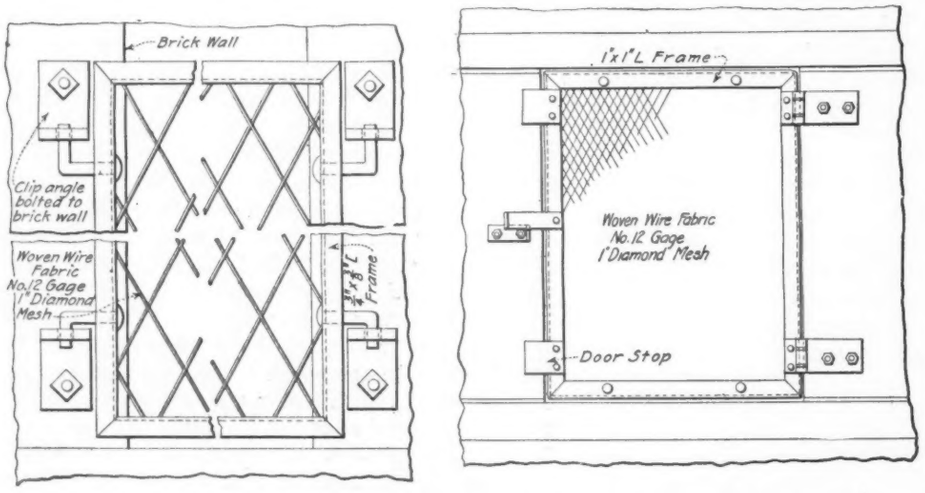


FIG. 14—SIGNAL BOX WITH RED AND GREEN LENSES THAT CANNOT BE INTERCHANGED WHEN REPLACING LAMPS

The opening in the bus compartments opposite insulators should not be left open but should be covered to avoid accidents. The cover should be transparent to allow for the inspection of insulators and should be perforated to allow for ventilation. A small hinged door, made up of wire mesh with an angle-iron frame (Fig. 13), will no doubt give satisfaction. For the disconnecting-switch compartments or other compartments not containing oil vessels it is neither necessary nor advisable to install solid asbestos or metal doors, since wire-mesh doors are sufficient for protection and have the additional advantage of facilitating inspection and of giving ventilation. The rear compartments of a structure are generally very high, thus making it necessary to arrange the door in sections, and great care should be taken to design them in such a way that the upper section will not accidentally fall off and injure the operator when he is removing the lower door. Fig. 12 shows a simple construction of a wire-mesh door the mounting of which is so arranged that the lower section when being removed cannot touch the upper section.


Brick Wall
Clip angle bolted to brick wall
Woven Wire Fabric No.12 Gage 1" Diamond Mesh
1"x1"L Frame
1"x1"L Frame
Woven Wire Fabric No.12 Gage 1" Diamond Mesh
Door Stop

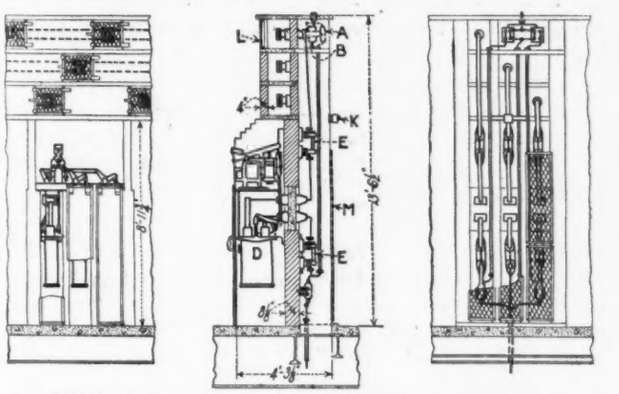
FIGS. 12 AND 13—TWO TYPES OF WIRE-MESH COMPARTMENT DOORS

The first is for rear compartments and is arranged so that the upper part will not fall out of place while lower hinge is being disengaged. The second door is for compartments opening opposite insulators.

Signals.—At each oil circuit breaker there should be a red and green lamp to indicate whether the respective disconnecting switches are open or closed, to protect an operator when inspecting or repairing the breaker, and at each set of disconnecting switches there should be a red and green lamp to indicate whether the respective oil circuit breaker is open or closed, to prevent the opening of a disconnecting switch under load. A suitable box for such signals, with red and green lenses, is shown in Fig. 14. This box is so arranged that the possibility of interchanging red and green lenses when replacing lamps is avoided.

†See ELECTRICAL WORLD, Jan. 15, 1916.

Grounding.—All uninsulated metal parts of apparatus should be thoroughly grounded. It is advisable to install a ground busbar on the oil circuit breaker side as well as on the disconnecting-switch side and to make all ground connections to it. At each oil circuit breaker there should be a suitable fitting on the ground bus



A 2300 Volt pot. fuse
B 2300 Volt pot transformer
D Oil circuit breaker, W.E.&M.Co. Type E-6, 300 & 1200 Amps. 2300 Volts
E S.P.S.T. Disc switch G.E.Co Type LG-16 300 & 800 Amps 2300 Volts
K Signal lamp to indicate whether oil circuit breaker is closed or open
L Bus door-screen in angle frame
M Compartment door-screen in angle frame

FIG. 15—MODERN 2300-VOLT BUS STRUCTURE

for the purpose of quickly grounding a circuit breaker when repairing or inspecting it.

Conduits.—Great care should be taken in the preliminary design of a bus structure, as well as in the floor construction under it, to allow for the necessary conduits for oil-circuit-breaker control, instrument transformer secondaries and signal wiring. Conduits should be exposed, instead of being concealed in walls, to allow for changes in wiring and interchanging of circuits after installation. For this reason all junction boxes should be of very liberal dimensions and should be easily accessible.

General Arrangement.—After discussing in detail the various features of masonry bus structure, very little is left to be said about the general arrangement. As mentioned above, the back-connected bus support gives the simplest and best arrangement for buses and connections, and there will not be many cases where this arrangement cannot be used. For carrying capacities of 2000 amp. or over it would not be advisable to use a solid round copper rod through the wall. In such cases a similar arrangement can be made by using a square porcelain tube through the wall and cementing the proper number of flat copper bars in the tube, mounting the bus on one end of these bars and the connection to oil circuit breaker on the other end.

Various views of a very modern heavy-duty bus and switch structure for 12,000-volt, three-phase, and about 100,000-kva. generating capacity are shown in Figs. 6 and 7. Each circuit of this installation is equipped with two sets of oil circuit breakers, each connected to a separate bus. The disconnecting switches on both sides of the oil circuit breaker are operated by one common handle, and all the other improvements suggested above are incorporated in this structure. The generator-potential transformers are installed in compartments along the wall on the oil circuit breaker floor, whereas the bus-potential transformers are placed in compartments above the bus. This arrangement makes all the wiring direct and simple. A floor is installed between the oil circuit breakers and the bus, which should be done in all cases of very heavy duty, so that circuit-breaker explosions under extremely heavy short circuit should not affect the buses. Current transformers are not shown in these bus structures, since in this particular installation it was necessary to install the current transformer near the apparatus. However, it is obvious that no difficulty would be experienced in accommodating them in the structure.

Two 12,000-volt bus structures for small-capacity installations were shown in Figs. 8 and 9. It will be noted that no floor exists between the circuit breakers and the buses, since this is not considered necessary for small capacity. These structures also have all the improvements described above and are about as simple as bus structures could be made and at the same time be thoroughly reliable. It is obvious that, in spite of all the advantages which a bus structure of the type offers over the older types, its cost will not be higher, and in most cases will be lower, than that of the older type.

A 2300-volt bus structure for small capacity machines is shown in Fig. 15. The disconnecting switches in this structure have no mechanism and must be operated by a switch hook, therefore the signals at the oil circuit breakers had to be omitted. In all other respects, however, this structure follows along the lines of improvement suggested above. The potential transformers are mounted in compartments near the top of the structure, and for generator circuits it is necessary to bring the primary leads down to the generator side of the oil circuit breaker, which is at the bottom of the structure. This can be done in iron conduit, since the magnetic field caused by the primary current of a potential transformer would not cause much heating.

Lighting.—Care should be taken to illuminate all apparatus and other parts of the bus structure thoroughly.

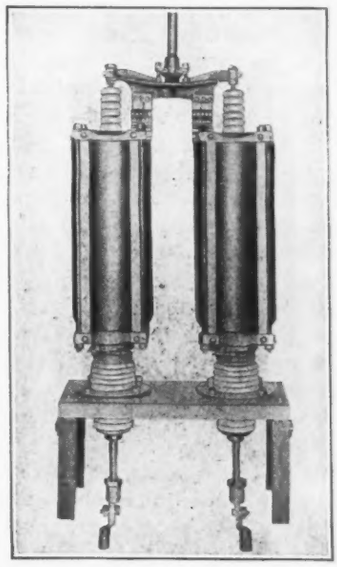


FIG. 16—SWITCH RATED AT 800 AMP. AND 15,000 VOLTS CAPABLE OF RUPTURING 600,000 KVA.

This should be done by carefully selecting and placing the lighting fixtures in a way to give good illumination without causing any glare. In addition, an ample number of receptacles for attaching portable lamps should be installed on both sides of the structure.

All bus structures described were designed and installed by the J. G. White Engineering Corporation.

POWER-FACTOR IMPROVEMENT IN NEW ENGLAND STATIONS

Recent Work in This Direction Outlined at Meeting of Boston Section of American Institute of Electrical Engineers

OUTLINES of work done in New England in power-factor improvement were given at a meeting of the Boston Section of the American Institute of Electrical Engineers by A. E. Pope, assistant general manager New England Power Company, L. R. Hicks of C. H. Tenney & Company, R. E. Argersinger of Stone & Webster, Boston, and others.

Mr. Pope stated that in 1916 the voltage conditions at some of the New England company's substations required remedying. These conditions were largely due to low power factor, and the use of condensers at once suggested itself. An investigation showed that condensers were justified for use during heavy load periods only, and two 7500-kva. machines were installed at Pawtucket, R. I., and Greendale, Mass., respectively, where the power-factor conditions were most undesirable. The results in improved regulation and in effect on system losses have been most satisfactory.

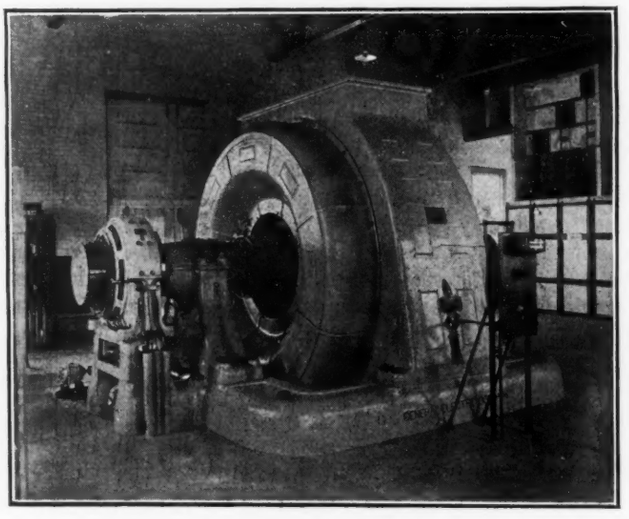
During the past year the company's power factor has again become low, owing to largely increased load, additional substations, etc., and a more exhaustive study of the conditions is being made. Readings have been taken on each customer's installation, with the exception of some of the smaller ones, and a classification of results shows in round numbers about 10,000 kw. between 60 and 70 per cent power factor, about 23,000 kw. between 70 and 80 per cent, about 6000 kw. between 80 and 90 per cent, and about 10,000 kw. between 90 and 100 per cent. Additional load is also carried where the company is tied in with other systems.

From the above study the composite power factor of the New England company's load at the points of delivery is found to be about 82 per cent. A further analysis of system losses with the application of proper power factors to each, combined with the above, gives a resultant power factor of about 72 per cent at the buses of the various generating stations. The actual readings at the stations with no condensers operating are about 2 per cent higher than this calculated result. There appears to be little question that the reactive effect of the lines and transformers should properly be corrected at the substations, and in this connection a third condenser of 7500-kva. rating has been ordered for installation at Fitchburg, Mass. With these three units in operation the power factor at the generating stations will become practically equal to that at the points of delivery.

The next step will be to better the conditions existing at the customers' installations, both present and future. The company believes that any properly motored mill should operate at an average power factor of 80 per cent or better, and future New England Power contracts will carry a power-factor clause based on 80 per cent minimum and impose penalties for lower power factor of probably 5 per cent between 70 and 80 per cent power factor, 15 per cent between 60 and 70 per cent, 25 per cent between 50 and 60 per cent and 50 per cent below 50 per cent. The company is taking up with its present customers, particularly those having the lower power factors, a study of their mill conditions with a view to locating any cases of over-motoring. This is a large undertaking, but it is hoped that the results will justify the effort. In one mill where such a study has been made the motors were rearranged to such good advantage that the power factor has been increased from below 80 per cent to 88 per cent and six spare motors have been rendered available.

No attempt is being made at this time to persuade customers to install condensers of their own. With the possible exception of the larger customers it is felt that if this proves desirable, it can perhaps be done more economically in the substations in large-capacity condensers than at the individual customers' plants. It is hoped by the above methods to raise the customers' composite power factor to between 85 and 90 per cent, which appears sufficient under present conditions. Mr. Pope said:

> A general study of condensers and their effect on system regulation is at first discouraging. Most of us have been educated in the idea that condensers can be economically used to correct power factor up to 90 per cent but no higher. This is true when the object is only to save capacity in generators, transformers, etc., but it is quickly found that in their effect on regulation the great benefit is obtained above 90 per cent. To reach this means an excessive use of condensers, and a comparison of losses in various condensers versus line losses at low power factor tends on the average system to place the economic limit to which we can afford to correct by condensers at between 80 and 85 per cent.



SYNCHRONOUS CONDENSER RATED AT 7500 KVA. INSTALLED AT WORCESTER, MASS.

Further analysis is more encouraging, however, and tends to show that this figure is reasonable. For instance, if the total regulation in a system from the generating bus to the substation bus is 25 per cent under full-load conditions at 80 per cent power factor, it will be found that at least 10 or 12 per cent of this exists under minimum load conditions, due to the much lower power factor at such time caused by the increased effect of the transformer core losses. In other words, this much of the regulation is constant and can easily be taken care of by the ratio of transformation. In almost any hydroelectric system another 6 to 8 per cent can be taken care of at the generating stations, which leaves a net regulation at the substation bus of from 5 to 8 per cent. This is really what we are interested in. An increase in the power factor of from 80 to 90 per cent will improve the regulation to the extent of at least 5 or 6 per cent, which practically eliminates the effective regulation at the substation bus. In other words, condenser action must be considered, not in relation to the entire regulation involved, but only to that

portion of the entire regulation which cannot be corrected by other and more economical methods.

The author stated that he considers this question of most vital importance to central stations and particularly to transmission systems. The tendency of mills to over-motor is one which must be fought at every turn, and in this the manufacturers, who are in many cases the mill engineers, must help. The present design of synchronous motors makes them more applicable than in the past, and here again the manufacturers should use their influence, not only in the sale of the present sizes, but in the further development of smaller units.

J. A. Walton, Boston Edison Company, stated that a power factor of at least 80 per cent is sought on all new installations and that a rate taking the power factor into account has been established for all customers having 50 kw. demand or more, the customer being penalized for all power factors under 80 per cent. In an installation with 200 kw. load and using say 300,000 kw.-hr. yearly, this would mean a rate of 2.5 cents per kilowatt-hour for 80 per cent power factor and 2.7 cents if the power factor was 70 per cent. In the later substations synchronous motor-generator sets or rotary converters are being used widely. During the day the power factor at the L Street generating station in South Boston ranges from 80 to 85 per cent, and on the peak it is raised to from 90 to 95 per cent. No static condensers are in use so far on the Boston system.

Mr. Hicks pointed out that a 4000-kw. synchronous condenser has been installed through an agreement between the Bristol & Plainville Tramway Company and the Connecticut Power Company for power-factor improvement. The former power factor was 60 to 65 per cent, and it was estimated that from 2000 kw. to 2500 kw. would raise this to 85 per cent. Wattless component integrators are used, and the tramway company pays for correction up to 85 per cent, the power company paying for any correction in excess of this. In one month's service the tramway company purchased 1,250,000 kw.-hr. from the power company and 40,000 kw.-hr. was required in operating the synchronous condenser. Ordinarily this machine is run from early forenoon to about 5 p. m., or from fifty to sixty hours per week, under control of the power company's load dispatcher. In the case of an industrial plant at Bristol the installation of a synchronous condenser will obviate the duplication of distribution lines serving a brass mill, and at Montpelier, Vt., and Oswego, N. Y., the use of such equipment on Tenney properties has saved fuel by making it unnecessary to run extra steam-plant equipment. R. E. Argersinger cited the saving of $2,800 per year by the use of a static condenser costing $7,500 on the lines of the Abington & Rockland company in Massachusetts. Before the condenser was installed the average load on the line was 650 kw.; afterward it was feasible to handle 950 kw.

Flexible Distribution for Industrial Plants

System of Busbars Meets Changing Demands for Power—Safety and Low Operating Costs Also Secured by the Employment of Busbar Feeders of Uniform Size

BY L. F. LEUREY
Consulting Engineer, San Francisco

IN INDUSTRIAL power installations of large size and of diversified demands important advantages can be secured by a well-proportioned design of main feeders and sub-feeders of a uniform size. The important results to be obtained are these: First, flexibility is assured in meeting the necessary growth of the system and in accommodating the shifting of motors incidental to improvements in the industrial process. Second, by reducing to a minimum the variety and sizes of materials required installation costs are reduced and a better purchasing leverage is secured. Third, by reducing the number of fuse locations and by simplification of arrangement a minimum of upkeep cost and a reduction in interruptions is secured.

To illustrate how this method of distribution can be applied a specific example will be referred to—the plant of the California & Hawaiian Sugar Refining Company, Crockett, Cal.—and the determining reasons for adopting this method will be outlined.

From the viewpoint of the refinery management three things were of primary importance—first, that the design meet all present requirements of the Pacific Board of Fire Underwriters and the Industrial Safety Commission of California; second, that the trend of modern precautions against fire and personal risk be taken into account; third, that the design must be capable of meeting extension of plant capacity and flexible enough to accommodate the frequent shifting of loads incidental to improvements in sugar refining.

The connected load at this refinery consists of approximately 400 motors, ranging in size from 1 hp. to 200 hp. and aggregating a total of 6000 hp. These motors drive a very wide range of machinery, including many types of conveyors and pumps, reels and screens,

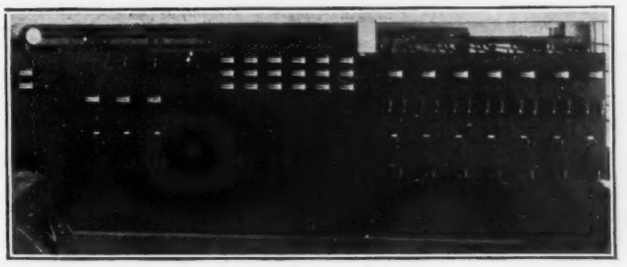
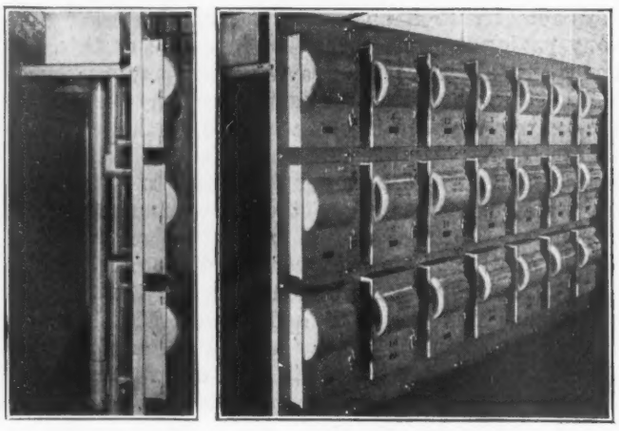


FIG. 1 — PORTION OF MAIN SWITCHBOARD WITH EXCITER AND GENERATOR PANELS AT LEFT AND SEVEN FEEDER PANELS AT RIGHT; BUSBARS ARE OVERHEAD

centrifugals and machine tools. Owing, however, to the fact that a definite tonnage of bulk product is traveling through this refinery each hour of the twenty-four the total load is very uniform, and it is only at local points that any unusual demands exist.

Main Switchboard.—The source of power at this refinery consists of non-condensing turbo-generators operating at 480 volts, three-phase, 60 cycles, the exhaust steam being used in the sugar-refining process. The

main switchboard is of conventional design, consisting of three electrically operated generator oil switches of 3000-amp. capacity and of fourteen remote-control manually operated feeder oil switches rated at 500 amp. each. Seven of these feeders are on each end of the bus with generator connections in the center. On account of heavy currents carried, the copper bars of each



FIGS. 2 AND 3—SIDE AND FRONT VIEW OF SEVEN-PANEL IRONCLAD DISTRIBUTION BOARD

This board controls twenty 30-hp. motors and one group of small motors. The supply circuits enter the bus compartment at the top and to the rear of the board through 3-in. conduits, while smaller conduits inclose the connections between the switches and busbars.

phase in the main bus are arranged in a hollow square and are transposed at three places in the length of the bus.

Main-Feeder System.—In determining the size of the main feeders the following considerations were involved:

First, the feeder must be of large carrying capacity to minimize the number of feeders and oil-switch controls, but not so large as to be uneconomical because of skin effect.

Second, the size must not be so great as to make an unwieldy and over-costly conduit system. Owing to the fact that sugar refineries are necessarily densely packed with machinery, shafting and pipes, a conduit system was essential, even if its many other advantages had been overlooked. This very space congestion which forced a conduit design increased the cost of installation.

Third, high electrical labor cost was another important factor in considering a compromise between a minimum number of conductors and a unit conductor not too expensive to install.

With these considerations in mind, it was decided to adopt three 500,000-circ.mil cables and 3-in. (7.6-cm.) conduit as the envelope. The feeders were all kept at this uniform size, as it was the aim and intent of the design so to arrange and route these feeders that all would have approximately the same value of average load. The great diversity of loads and many motor units made this comparatively easy of accomplishment without any forced application of the principle involved.

These main conduits begin in the power house with a porcelain-lined bushing near the feeder terminals of the 500-amp. oil switches, from which point they drop beneath the floor line and there are ganged in a single conduit rack to the first point of divergence. At this point a sheet-steel junction box, approximately 24 in. by 24 in. (60 cm. by 60 cm.), is installed, and the feeders are separated in sub-groups leading to various sections of the refinery. Wherever possible these main feeders are routed along the main passageways of the buildings and ganged under single supports at all possible points. Wherever the length of the runs makes it impossible to use standard sweep elbows a sheet-steel junction box of heavy construction is installed. In order to carry out continuity of the metallic bond on these conduits the external lock-nuts which clamp these conduits to the junction boxes were welded by the oxy-acetylene process to both the conduit and junction box. The power-station ends of all of these main conduits are connected solidly to a large copper ground plate buried in the moist earth below the buildings. Auxiliary grounds are also made to the permanent water-pipe systems.

The main feeders serve two typical groups of loads. In one case the loads consist of several motors of from 75 hp. to 150 hp. capacity controlled from a single group cabinet, at which cabinet the starting compensator for these motors is installed. In the other case these main feeders are run to sheet-steel distribution switchboards for the control of a large number of smaller motors. In all cases this second type of feed is extended sufficiently to take on a load which will work the feeder to an economical limit, and, as far as possible, the feeders are so routed as to embrace within their scope loads of certain definite sections of the refinery.

Sub-Distribution Switchboards.—In planning the location of the sub-distribution switchboards the size and extent of the area to be served by sub-feeders was kept in mind, and the characteristics of machinery on

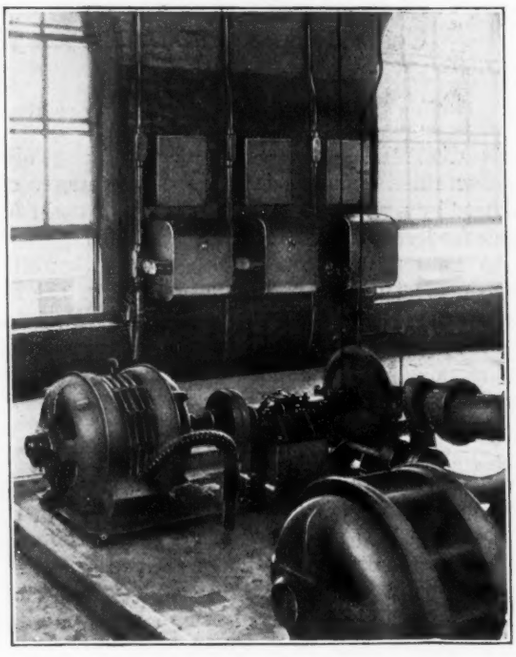


FIG. 4—IRONCLAD SWITCHES AND CONTROL FOR MOTORS WITH ALL WIRING PROTECTED

the various floors were so studied that these boards were placed as near as possible to the load centers with a view to minimizing the length of sub-feeder conduits. The position of these boards was naturally governed by a compromise between extending the main feeders and extending the sub-feeders.

These boards consist of units of No. 12 gage sheet

steel, 18 in. wide by 84 in. high (46 cm. by 213 cm.), mounted on 2-in. by 2-in. (5-cm. by 5-cm.) angle-iron supports. Each panel carries three 100-amp., three-pole, 500-volt alternating-current externally operated switch units. Near the top and at rear of the panel is a sheet-steel bus compartment approximately 10 in. by 15 in. (25 cm. by 37 cm.) in section, made of code-thickness metal. Different numbers of these panel units are grouped together to form the switchboards, the bus compartments being made of sufficient length to cover the backs of all panels installed. Each compartment is designed with a view to a single-panel extension so that panels can be added from time to time as desired. The bus material is supported on cleat insulators and consists of the same material as is used in the main feeder. All taps from switch units to bus compartment and from switch units to sub-feeders are in conduit and enter the switch unit from the rear, being held to the switch by means of lock-nuts and bushings. The taps from the upper lugs of the switch to the bus are made with standard N. E. C. wire; for convenience all taps from the three units on one panel are connected to the bus at a single point.

In practice these steel switchboards have certain excellent advantages, one of which is that they consist of only three standard materials easily obtained in any market, namely, externally operated ironclad knife switches, sheet-metal panels and angle-iron framework. The material for connecting them consists of standard conduit and fittings, which are always available, and the bus connections and buses are ordinary National Electric Code wire and cable. One other very important advantage, especially in congested industrial installations, is the absolute safety from personal contact, which not only insures the safety of workmen but also prevents interruptions to service. The latter advantage in turn produces the complementary feature that in very crowded conditions where machinery space is highly valuable these boards can be placed within 2 ft. (60 cm.) of the wall and in the most congested quarters without danger from accidental contact or disturbance of service. At the plant of the California & Hawaiian Sugar Refining Company every branch switch in service on these switchboards is kept locked, and it is a common procedure to send a painter unattended to one of these switchboards and allow him to paint it in place, front and rear, without any possibility of injury to the man or disturbance to the service.

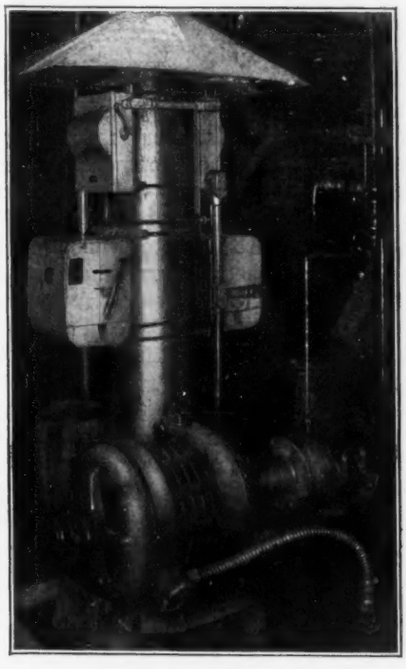


FIG. 5—IRONCLAD SWITCHES AND MOTOR CONTROL MOUNTED ON POST CLOSE TO MOTORS

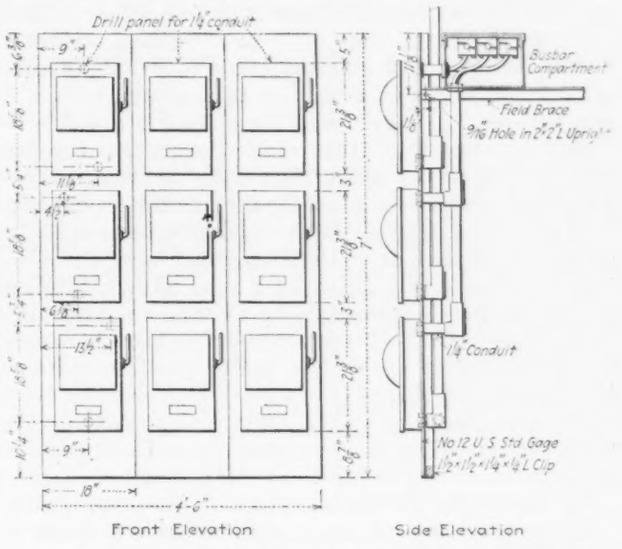


FIG. 6—DETAILS OF IRONCLAD INDUSTRIAL SWITCHBOARD

The panels, as designed, are exceptionally flexible. In one case in this refinery, by the use of one spare panel, a complete switchboard has been moved to make room for important machinery without any interruption to the service. It has developed in practice at this plant that each branch feeder on these boards will control single motors rated from 30 hp. to 40 hp., two motors of 20 hp. capacity, or as many as three to ten motors of smaller capacity. Since the average controlled horsepower per circuit is about 50 hp., each 18-in. (46-cm.) panel unit, with its section of bus, controls a total of 150 hp. The cost installed per panel of five-panel to seven-panel boards of this type averaged under war conditions $120, or 80 cents per horsepower controlled.

Where the distribution involves only the control of two or three large motors of from 75 hp. to 150 hp., another type of control panel, a sheet-steel compartment, is used. This contains a quick-break disconnecting switch, current transformers, starting fuses and an overload relay with an ammeter mounted externally above the door. The framework that supports this cabinet is also designed to carry the starting compensator. On account of the necessity of having current transformers and of using an older type of auto-starters on hand, it was impracticable to use externally operated disconnecting switches for this work.

Sub-Feeders.—In studying the question of sub-feeders for this refinery, the characteristics both of the load and of the industrial processes were kept in mind. Most of the buildings served were of from five to nine stories in height and all of relatively compact floor space. This arrangement favored sub-feeders of moderate size, because they would not involve any great length in run from the sub-distribution switchboards before accumulating the necessary amount of load. The basic plan kept in mind in running all of these feeders was that, in order to meet the many changes both in motor

horsepower and in the necessary rearranging of machinery, it would be necessary to gridiron, so to speak, the whole area with sources of power.

A uniform feeder consisting of three No. 1 wires inclosed in 1½-in. (3.7-cm.) conduit was selected, which size of wire permits operating the 100-amp. switch units on the distribution switchboards at full rating. These feeders are run in some cases to individual motors of 40-hp. capacity, but in most cases they are extended with full wire and conduit size to scattered motors of smaller size. In most cases these feeders are run beneath the floor slab from which the motors are controlled, and only a short riser full-size wire and not fused is necessary to reach the control equipment. Full advantage is taken of the variation demand factor of these small motors, so that the copper is always working at high efficiency, but, as a rule, with a sufficient reserve over the fuse capacity to take on reasonable increments of load. Wherever possible two or more of these sub-feeders are ganged under one run and open into common tapping boxes, so that an excellent arrangement is obtained for transference of load from one of these sub-feeders to another when desired. In running these feeders through the floor where future loads were expected or possibilities of loads might occur due to shifting of equipment, tapping boxes were installed at

FIG. 7—TYPE OF SWITCHBOARD THAT MAY BE PAINTED OR WORKED AROUND WITHOUT ANY HAZARD

intervals in the line. All of the taps in these boxes are unfused and the conductors are continued in full-size wire to the control equipment to be connected.

While this system may seem expensive, the high cost is only apparent, because in the conventional method of running from a central distribution switchboard to all individual motors, the wire and conduit both are proportioned to the starting capacities of the motors, and their individual efficiency is very low.

Starting Equipment.—The starting equipment for all motors of 5 hp. and less consists of P-10 oil switches with no-voltage release and time-element fuse-plug protection. For motors over 5 hp. type "A" auto-starters are used, in which the no-voltage release and the over-

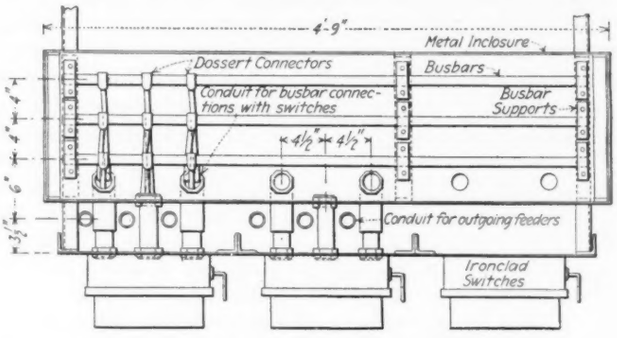


FIG. 8—SECTION THROUGH BUSBAR COMPARTMENT

load relay are inclosed within the housing of the starter. In the installations with which auto-starters are used they are preceded by externally operated disconnecting switches fused for the starting current of the motor, the disconnecting switch and auto-starter being interconnected with full-size wire to the sub-feeder. The outgoing side of the compensator is connected with required code-size wire to the motor controlled, the whole installation being ironclad throughout. The use of bottom-fused ironclad disconnectng switches, fused for the starting current of the motor, complied with the requirements of the Underwriters as well as the orders of the California State Industrial Accident Commission, which requires that all fuses having a potential of 300 volts or more to ground must be preceded by isolating switches.

Both the units for controlling motors under 5 hp. and the units consisting of compensator and disconnecting switch for motors over 5 hp. are arranged on standard racks wherever possible, so that the whole unit can be moved with the motor when required. The installation of disconnecting switches preceding the motors having compensators, aside from meeting requirements of the code and safety commissions, has the additional advantage of permitting examination of the starting-compensator contacts with a minimum interruption of service.

Wherever conditions permitted the starting equipment was installed so that it was either within view of the motor to be started or within view of some visible unit in the train of gear being driven. All starting equipment, sub-feeder conduit and distribution switchboard are thoroughly grounded throughout.

Conclusion.—In planning and executing this entire work it was always kept in mind that the electrical arrangements were not complete in themselves but were only one part in a complete industrial train of equipment. Certain definite requirements of the fire and safety codes naturally decided many features of the installation, but in many other features the requirements of operation were the governing factors.

That the flexibility aimed at has been secured is amply proved by one year's operation. In spite of many and important shifts in load centers due to rearrangement of equipment, additions, etc., it has not been found necessary to modify one feature of the permanent work.

THE ENGINEER THE IDEAL LINK BETWEEN CAPITAL AND LABOR

Dean Cooley Thinks This One of the Technical Man's Important Functions—More Liberal Education Is an Imperative Need

IN AN article published recently by the *Evening Sun* of New York Dr. Mortimer E. Cooley, dean of the Colleges of Engineering and Architecture of the University of Michigan, makes a plea for a wider field of usefulness for the engineer, urging that the nature of his work affords him an excellent opportunity to become a link between the forces of labor and capital and that he should also take a more prominent part in public affairs. Dr. Cooley emphasizes the need for the education of engineers along less highly specialized and broader cultural lines. He begins by saying:

In the present-day maelstrom of social and industrial unrest which, according to the press of America and Europe, is menacing the civilized world, many curative measures have been suggested. The most powerful agent, however, is the workingman himself. I believe that the highest type of constructive "workingman" is the professional engineer, who is the connecting link between capital and labor.

Our entire material world, so far as social structure is concerned, can be very justly credited to the engineer, or to professional men intimately allied with the engineer. Our great buildings, our transit lines, our industrial plants, our national and international communications by wire, wireless, mail and steamship, and the distribution of our wares, all owe their origin and comparative perfection to the engineer.

And yet there is one phase of the engineering profession which is little understood—even by men of the calling—which is of even broader value to the nation than that of material advancement. This is the relation of the engineer, in the different branches of his science, to the worker—the hewer of wood, the forger of iron, the carver of stone—who typifies the constructive half of our civilization known as "labor" and his equal and important intimacy with the other, the provisioning and directing half, usually termed "capital."

If we are to solve the tense problems which have arisen through the last few years of bloodshed, misery and spreading dissatisfaction with certain of our living conditions, no saner, surer mediator can be found between the classes than the man who proves to both "upper" and "lower" strata his sincerity, working ability and right to adequate reward—the engineer.

To even the simplest of the labor forces the engineer, many times working with them, unshaven, unshorn, wearing muddy overalls, speaking in the patois of the workers while wielding his magic pen and pencil with the wizardry of the laboratory and the classroom, represents a higher force than the wage earner—power which justly deserves infinitely greater reward.

The engineer is to the workingman who materializes his blueprints and obeys his personal directions the symbol of science, of intellect, of education and of that "teamwork" which is the keynote of modern achievement. In his task and his ability he is one of the most powerful rebuttals of Bolshevism and industrial unrest.

To the employer and the capitalist whose profits depend upon his accuracy and energy the engineer is the governing factor of business success in production. His creative vision, growing from his scientific training and brought to fruition by the virility of his practical executive ability, is the foundation of modern achievement in a thousand ways.

THE ENGINEER IN PUBLIC LIFE

Turning to the question of citizenship and civic service, Dean Cooley continues:

There is even a greater field of achievement for the engineer, one in which his past works have given him unique power and justification. This is in the line of unselfishness—creative, scientific participation in citizenship. America's towns, cities, states and the nation itself all need more expert aid and advice in the multifold problems of government and growth. The engineer should devote more of his abilities to the general good, and the public should more persistently seek his aid.

In short, the engineer should enter public life, giving his talents and technical skill for the good of his neighbors. Local engineering societies in the various towns and cities should coöperate with their neighbors and with municipal authorities not only in technical problems but in social and industrial as well, because of their unusual knowledge of and acquaintance with people of all classes. Their ability as mediators of labor problems, their scientific knowledge of the details of public matters, should be given without charge for the general good.

As to state and national problems, we need more engineering skill in the direction of executive matters. Lawyers seem to predominate in nearly all lines of general public life; yet there are questions of international importance in every branch of government work which need administration by scientifically trained minds.

The lack of engineering experts is due as much to the unwillingness of the engineer to enter political life as to the public's failure to urge him to do so. Engineers do not like politics; yet politics—in government—are necessary to every phase of modern society and industry. How many engineers are there in Congress, in Cabinet positions—even in public service commissions? In labor boards and boards of trade?

THE EDUCATIONAL NECESSITIES

To fill great positions in national and municipal life the engineer must receive a broader, more human and less specialized training than he is getting to-day in the university courses. Dean Cooley says:

Vision, background, knowledge of life and the "humanities" suffer at the expense of an almost selfish concentration on laboratory methods. We must break down the walls which we are building around the new generation of young men in our colleges—walls so high that they cannot see over. We must so teach that the boys who are going to become engineers will not remain "privates" or "non-coms," but can be field officers and line officers of the highest ranks, qualified to command and campaign from the hilltops, looking far ahead and with historic perspective.

We should develop in America a new kind of engineer by lengthening study courses, by broadening interests and by instruction in the wider-range subjects which deal with all sides of modern life. Our international leadership in industry, commerce and political idealism demands superior training for the young men who are to continue the administration of our affairs.

With the extension of international activities ahead of us as the results of war changes we must train our young scientific men in modern languages, in history, in economics, and above all in the essentials of general culture, that they may hold their intellectual own in competition with the scientists of other lands.

No longer is government simply the administration of a system of statutes, the collection of taxes and duties and the maintenance of a military system. It is a complicated machine by which the citizens themselves drive forward the great industrial, social, commercial esthetic and idealistic entity of the state—in which all their varied interests are inextricably bound. Commercial or industrial problems affect those of education and artistic development; the working classes, from the humblest wage-earner to the executive of the largest corporation, are dependent for their lives, comfort and happiness upon the efficiency of the government's many branches of direction and agency.

And so it is that the designers of our railroads, our electrical systems, our manufacturing plants and machinery, our steamships, our sanitary systems, our defensive weapons—the army, navy, signal, supply and air services—should be prepared for their broadening task with a broadening, cultural education. Our future engineers should stand head and shoulders above the present professional man of to-day to fulfill their duties to the nation and to themselves.

Interconnection Reduces Steam Reserve Necessary

Benefits Which Have Been Realized by Tying Together Power Systems in Central California—Improvement of Diversity Factor and Pooling of Water Power Resources Have Proved of Great Advantage

BY L. J. MOORE
Electrical Engineer, San Joaquin Light & Power Corporation

ONE of the important advantages obtained by the interconnection of neighboring transmission systems operating hydroelectric plants with steam reserves is the reduction of steam reserve necessary to maintain reliable service. This is brought about in two ways — first, by the improvement of diversity factor by the connecting together of dissimilar groups of load, and, second, by the pooling of water resources. An instance of the realization of this advantage is found in the interconnection of the systems of the San Joaquin Light & Power Corporation, the Mount Whitney Power & Electric Company and the Southern California Edison Company, all operating in the central and southern districts of California.

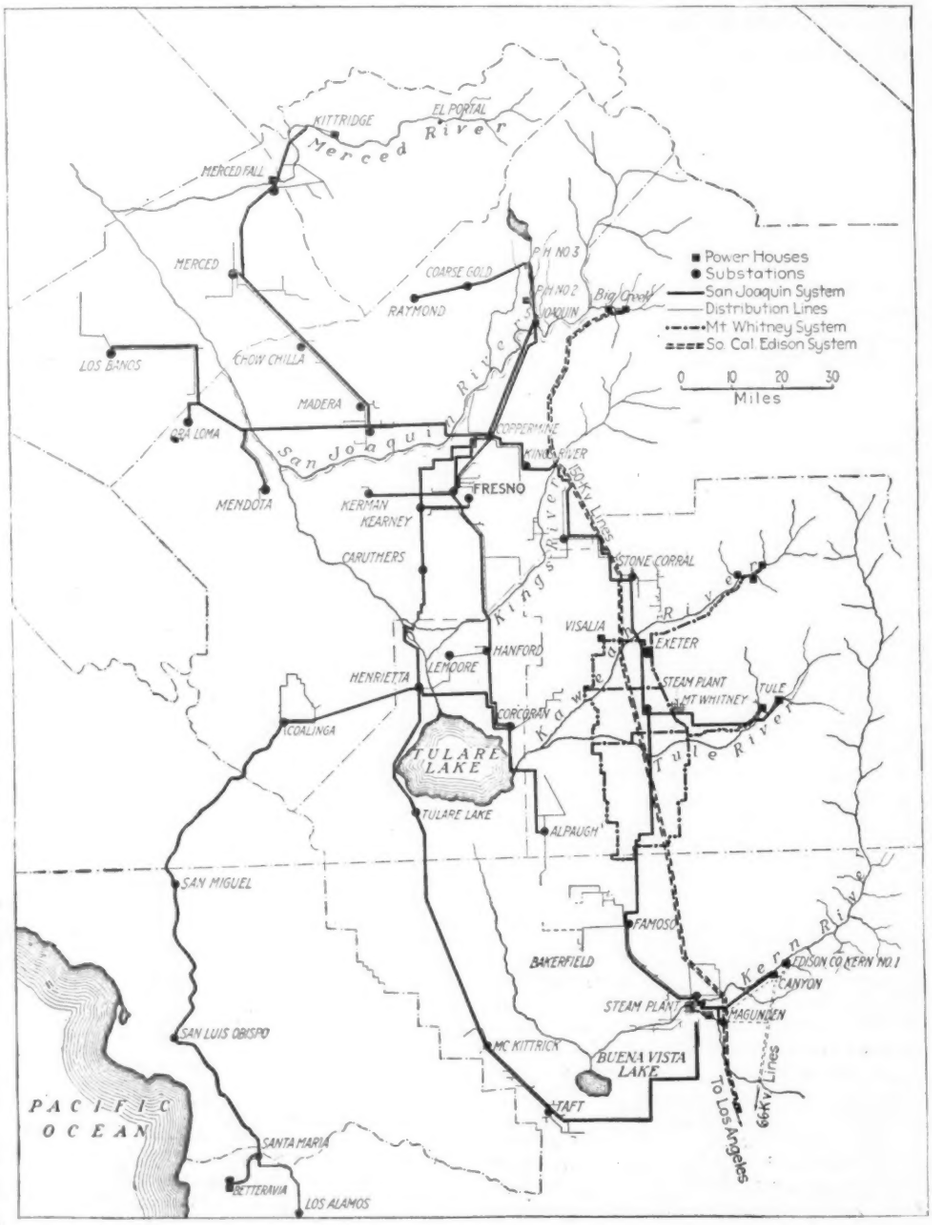


FIG. 1—SAN JOAQUIN, MOUNT WHITNEY AND PART OF SOUTHERN CALIFORNIA EDISON SYSTEMS, THE INTERCONNECTION OF WHICH BROUGHT MANY BENEFITS

Briefly, the San Joaquin Light & Power Corporation operates nine water-power plants on the San Joaquin, Merced, Tule and Kern Rivers. Water storage for the San Joaquin River plants only is provided in the 45,000-acre-foot (5550-hectare-m.) Crane Valley reservoir. Steam reserve is provided in a 12,000-kw. plant at Bakersfield and a 2000-kw. plant at Betteravia. The Southern California Edison Company supplies power to Los Angeles and southern California and has in the central California district a plant on Kern River near Bakersfield and the two well-known Big Creek plants. The Big Creek plants have 88,000 acre-feet (10,900 hectare-m.) of storage in the Huntington Lake reservoir. The company also operates other water-power plants in southern California and has steam reserve in the Long Beach plant, as described in the ELECTRICAL WORLD for Aug. 24, 1918, and the Redondo plant, built by the Pacific Light & Power Corporation before that company was consolidated with the Edison company. The Mount Whitney Power & Electric Company operates plants on the Kaweah and Tule Rivers. It has no water-storage facilities but does have a 5000-kw. steam plant at Visalia. The Edison company operates at 50 cycles, but the other companies use 60 cycles. The

system of the San Joaquin company and the lines of the others directly involved in the interconnection are shown on the accompanying map (Fig. 1).

The necessity for storage or steam reserve for hydroelectric plants operating in this region is well shown by the accompanying curve (Fig. 2), applying the San Joaquin system. The taller curve shows the total available water power of all the streams passing present plants of this company plotted in monthly average loads. The plants, of course, are not of sufficient capacity to utilize all the power at flood times. This curve of flow through the year is practically similar to the curve of each of the streams included. It shows the heavy flow in spring and early summer and the low discharge during late summer and fall, which are characteristic and which make it necessary for plants along these streams to be supported by either storage or steam reserve unless they be developed simply as minimum-flow plants. The flatter curve shows the load on the San Joaquin system for the year 1917 and makes evident the effect of the Crane Valley reservoir, which made it possible to carry the entire load by water. This

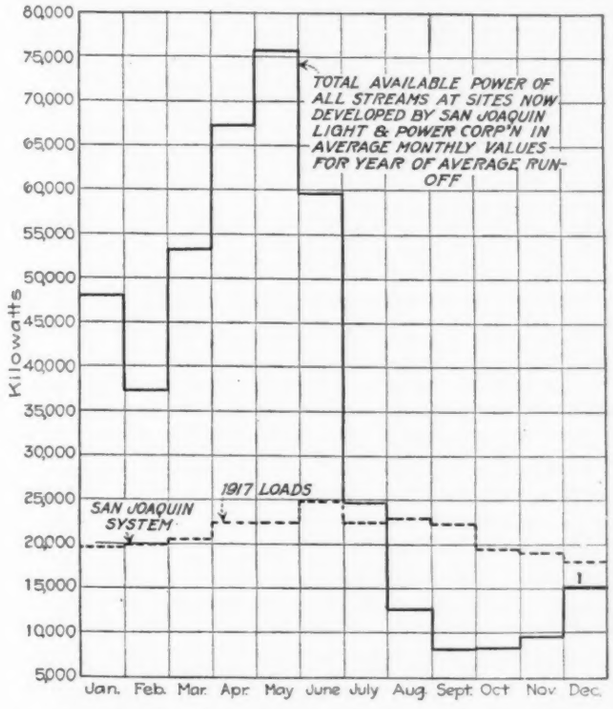


FIG. 2—CURVES INDICATE WHY STORAGE OR STEAM RESERVE IS VALUABLE

load is made up of industrial and lighting load in the towns, a large amount of oil-well pumping, which is practically continuous throughout the year, and a large percentage of irrigation pumping coming on only in the summer months.

The Edison company serves the same classes of business, but the railway and industrial part is much larger because of the larger cities reached, and the peak comes in November. The Mount Whitney company has a larger percentage of irrigation load, no oil-well pumping and probably less industrial load on account of the serving of smaller towns.

The first step toward interconnection came in 1917, when the Mount Whitney company became very short of power during the irrigation season owing to its lack of storage. This company is a subsidiary of the Southern California Edison Company, so an interconnection between the two was arranged to provide the necessary aid. At that time one 150,000-volt line from Big Creek to Los Angeles was in operation, but the second was only partially completed. The completed part, however, ran from the Mount Whitney territory south past the Magunden substation. Accordingly, a line insulated for 30,000 volts was built from the Edison company's Kern River No. 1 plant to Magunden. The Mount Whitney 30,000-volt system was connected directly to the 150,000-volt line, and Kern River No. 1 was also connected to it through the new line to Magunden. One unit at the Kern plant was then speeded up to 60 cycles and synchronized with the Mount Whitney system. Kern No. 1 normally transmits at 60,000 volts, so this arrangement necessitated a bank of transformers at the plant being reconnected for 30,000 volts. The distance of transmission was more than 70 miles (112 km.)—rather long for the low voltage used.

In the spring of 1918 interconnection between these two companies and the San Joaquin company was considered, both as a fuel-saving measure for all concerned and to allow the transmission of power from Kern No. 1 to the Mount Whitney company at 60,000 volts, this being the voltage of both Kern No. 1 and the San Joaquin system. Consequently three banks of transformers stepping down from 60,000 volts to 30,000 volts, of 13,500 kw. total capacity, were installed at Strathmore between the San Joaquin company's Tule River line and the Mount Whitney system. The line from Kern River No. 1 to Magunden passes the San Joaquin company's Kern River plant just across the river, so it was reinsulated for 60,000 volts and a tie was made between the two systems at that point through the necessary air-break switches.

Power is now delivered to the Mount Whitney system by Kern No. 1 placing as many of its four machines as necessary on the 60-cycle San Joaquin system and the Mount Whitney company taking out the equivalent through the transformers at Strathmore. If the Mount Whitney company does not need as much power as the Edison company is able to deliver, the difference is absorbed by the San Joaquin. On the other hand, when the Mount Whitney company has a surplus of power delivery is made by it to the San Joaquin system through the transformers at Strathmore, and the San Joaquin's Kern River plant supplies the Edison system operating at 50 cycles. This method of operation has the effect of storing flood water from the Kaweah River in Huntington Lake and is a regular procedure as far as the San Joaquin system is concerned, the plants on the Tule and Kern Rivers being run at maximum capacity during flood times, thus reducing the load on the San Joaquin River plants and increasing storage in Crane Valley Lake. Further advantage is obtained by the interconnection in that means are provided for interchange of power directly between the San Joaquin and Mount Whitney systems at Strathmore and interchange of plants between the San Joaquin and Edison companies on Kern River. Great aid has been rendered to all concerned on different occasions in cases of powerhouse and ditch troubles.

To decrease transmission losses still farther and improve power factor by the addition of more line capacity, the uncompleted Big Creek line with the 60,000-volt line from Kern River No. 1 to Magunden was paralleled with the east 60,000-volt line of the San Joaquin system by a connection between that line and the Big Creek line where they cross near Ducor.

This gave good results except that it complicated matters during cases of line trouble. As a result the connection was discontinued in January, 1919, a frequency changer of 5000 kw. capacity was installed at Magunden, and a tie line built from the San Joaquin company's Kern River line to Magunden, making possible an interconnection between the 60-cycle and 50-cycle systems. This, however, has not superseded the interchange of plants on Kern River. The 5000-kw. capacity of the frequency changer is not large compared to the capacities of the two systems connected, so careful manipulation of the load passing through it is required to keep the automatic switches from opening too often because of sudden variations of load on either of the systems. When no power is being transferred through the unit either system can use it for power-factor and voltage correction.

TYPICAL RESULTS WITHOUT FREQUENCY CHANGER

Typical results on Aug. 10, 1918, before the installation of the frequency changer, are shown in Fig. 3. The two lower curves show the Edison delivery to the San Joaquin system (the entire Kern River No. 1 plant was running at 60 cycles at the time) and the Mount Whitney demand at Strathmore. The separation of these two curves measures the amount of power the San Joaquin system was absorbing or delivering. These values added algebraically to the load of the San Joaquin system, had no interconnection existed, give the actual power delivered by the San Joaquin plants. The effect on diversity factor is shown by the two lower curves, where the changes in direction of flow of power at Strathmore are evident. This flow has been controlled somewhat on the day shown by variation of the load on the Visalia steam plant, but the fact remains that in practice often one system may be delivering power to the other at a time of light load for itself and peak load for the other, when within a very short space

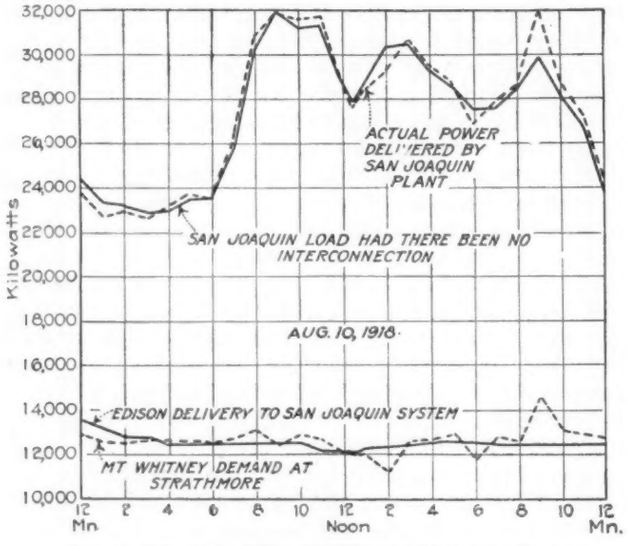


FIG. 3—TYPICAL RESULTS BEFORE INSTALLATION OF FREQUENCY CHANGER

of time the conditions may be completely reversed. This means that they help each other over peaks without the excessive use of steam necessary if they were all operating separately.

The Edison company realizes a saving in delivering power to the Mount Whitney in this way and preventing operation of the Visalia steam plant even at the expense of operating the Long Beach or Redondo steam plant, on account of the much greater efficiency of these two plants. It even pays to let San Joaquin's Bakersfield plant supply the difference, for the reason that Bakersfield is both more efficient than Visalia and because the plant is situated near the oil fields. Delivery of oil to the fire room is much less expensive, and besides

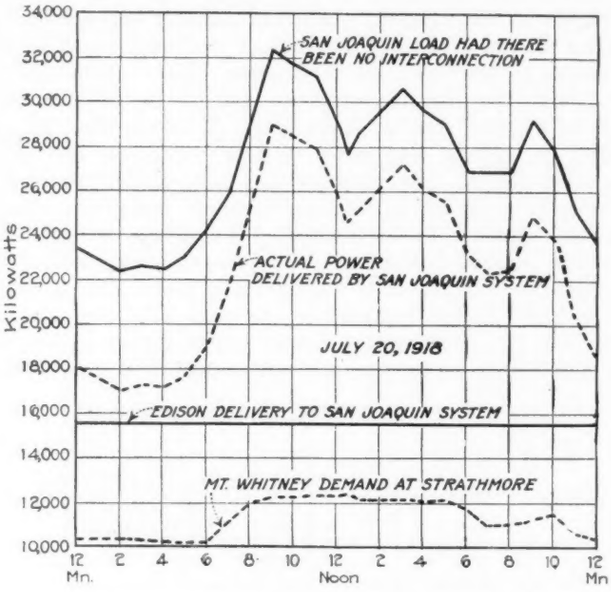


FIG. 4—CONDITIONS AFTER INTERCONNECTION BUT JUST BEFORE LOW WATER HAD RAISED MOUNT WHITNEY DEMAND

a large quantity of natural gas is burned. A gas-pipe line connects the Bakersfield plant directly with the oil fields.

The operation of the interconnected systems on July 20, 1918, is indicated by Fig. 4, which represents conditions just before low water had raised the Mount Whitney demand and decreased the Edison delivery; as a result a considerable quantity of power was delivered to the San Joaquin company.

When one of the 50-cycle impulse wheels at Kern River No. 1 is operating at 60 cycles it is found that the water necessary to generate 5000 kw. at 50 cycles generates only about 4500 kw. at the higher speed. Furthermore, the field current is only approximately two-thirds of normal under this condition. The San Joaquin's prime mover on Kern River is a turbine instead of an impulse wheel, but it gives somewhat analogous results in that a slightly higher output is obtained with the same water when operating on the Edison 50-cycle system. The field current is proportionately higher, too. No particular difficulties are experienced. In fact, the operation is quite satisfactory.

Books Received

LEKTRIK LIGHTING CONNECTIONS. London, England: A. P. Lundberg & Sons. Illustrated. Price, 10d.

PRINCIPLES OF RADIOTELEGRAPHY. By Cyril M. Jansky. New York: McGraw-Hill Book Company, Inc., 242 pages, 179 illustrations. Price, $2 net.

TRAINING FOR THE ELECTRIC RAILWAY BUSINESS. By C. B. Fairchild, Jr. Philadelphia and London: J. B. Lippincott Company. 155 pages, illustrated. Price, $1.50 net.

CONSUMING BITUMINOUS AND ANTHRACITE COAL*

What Must Be Done to Burn Mixtures of Steam-Size Anthracite with Soft Coal to Get the Most Steam from the Least Fuel

A boiler plant designed for soft coal and operating on natural draft is capable of using 20 per cent of steam sizes of anthracite mixed with soft coal without material loss in efficiency and without change of equipment, provided that sufficient grate surface is available, and this is usually the case. Still higher percentages of fine anthracite may be mixed with the bituminous, provided that certain changes are made in the furnace equipment. Between 20 and 40 per cent of small-size anthracite may be burned with bituminous coal by installing a blower in order to create the necessary draft pressure in the ashpit to penetrate the bed of fuel. When more than 40 per cent of small-size anthracite is to be burned it becomes necessary or advisable to change to grates having smaller air openings, smaller percentage of draft area and larger total area.

WHILE the essential difference between the burning of anthracite and the burning of soft coal consists, in the case of anthracite, in the use of a somewhat smaller volume of air per pound of fuel and a stronger draft, slight alterations in the method of firing and in the furnace designed for one or the other fuel are also necessary in case mixtures of soft and anthracite coal are used. Just what volume of air and what strength of draft must be used to burn any particular fuel in any given furnace can be determined only by actual trial and, being once determined, must be maintained as long as the particular fuel is used.

With ordinary furnace equipment designed for soft coal, up to 20 per cent "buckwheat" or fine sizes of anthracite may ordinarily be burned without any change of equipment or firing practice. Owing to the fact that most boiler furnaces are operated below their normal capacity on soft coal, the above percentage of anthracite can be added without decreasing the capacity of horsepower output of the boiler plant. If a greater percentage of anthracite screenings, 20 per cent to 40 per cent say, is mixed with the soft coal, it may be necessary, in order to obtain full boiler horsepower, to have the air pressure under the grate as high as 2 in. (5 cm.).

If blowers are not already installed, the turbine type may be fitted into the side wall of the ashpit very easily. It should not use more than 3 per cent of the steam developed by the boiler when operating at full capacity. The cost of a steam turbine blower is approximately $200 for boilers of 150 hp. or more.

If desired, a steam jet blower may be used instead of a steam turbine blower. This is cheaper, and the more economical types of steam-jet blowers are quite satisfactory in producing the desired results. In purchasing a steam-jet blower it is most important to investigate its steam consumption. The best type of these blowers will operate on about the same steam as that required by the turbine blower, whereas the poorer ones may take from two to five times that amount of steam, in which case they should not be installed. The cost of the steam-jet blower should be from $50 to $75 or more for a single boiler of 150 hp. and up. The turbine blower or the steam-jet blower should be controlled by means of an automatic draft regulator of the "partial throw" type, in order to obtain efficient results, although fair results are obtainable by hand regulation.

If more than 40 per cent of small anthracite is used, forced draft plus "buckwheat" grates and a good automatic draft regulator are recommended. The grates should vary in the matter of diameter of air openings, draft area and total surface in accordance with the specific fuels used and their proportions in the mixture.

Some plants are able to run efficiently with a good quality of fine anthracite alone if properly equipped for this purpose. The accompanying table furnishes additional data as to mixtures of various sizes of anthracite and soft coal that may be burned under different conditions of draft.

Proper mixing is most essential. It can be done either by delivering in a wheelbarrow alternate and predetermined portions of the two kinds of coal and then mixing by not less than two "turnovers" with a shovel before pumping in front of the furnace, or, on a larger scale, by a similar delivery of carload lots to the coal tipple.

Grates.—Grates for the fine sizes of anthracite have small air openings which vary in form from round holes, as in the pinhole grates, to elliptical holes and straight slots, the width of slot or the diameter of the hole varying from $\frac{1}{8}$ in. up to $\frac{5}{16}$ in. (3 mm. to 8 mm.). The percentage of draft area through the grate would vary from 3 per cent to 30 per cent.

Stationary, shaking or dumping types of grates for burning the fine sizes of anthracite may be obtained. The dumping and shaking types facilitate the cleaning of fire with less drop in steam pressure, which is an important feature. A large ash pit is advisable so that fires may be cleaned by dumping or shaking grates without the necessity of opening the ash-pit doors more than once in twenty-four hours. The ash-pit doors with forced draft are, of course, sealed to make them air-tight, and therefore the less often they have to be opened the better. Or, still better, separate the undergrate air chamber from the ash pit and install a dead plate in front of grates to dump ashes.

Owing to the slower rate of combustion, the grate area for small-sized anthracite is made larger than for bituminous coal in order to develop the same horsepower, except in cases where the soft-coal boiler already has an unnecessarily large grate, which is ordinarily the case. The relation of the grate area to the heating surface is also of importance. This relation is shown below:

For No. 1 buckwheat the proportion should be 1 to 40
For No. 2 buckwheat the proportion should be 1 to 35
For No. 3 buckwheat the proportion should be 1 to 30
For No. 4 buckwheat the proportion should be 1 to 25

The fuel bed should not be less than 6 ft. (1.8 m.) from any point of the boiler-heating surface. There should be from 2.5 cu.ft. to 3 cu.ft. of combustion space to 1 sq.ft. of grate area (0.78 cu.m. to 0.89 cu.m. per sq.m. of grate area).

Another detail of furnace construction which is important is that of the division of the heating surface into the so-called passes. As the furnace gases in passing from the fuel bed to the stack are continuously cooling, their volume is consequently decreasing con-

*Presented through the courtesy of the Fuel Engineering Section of the United States Fuel Administration, and based on information contributed by William P. Frey, fuel engineer.

tinuously, so that the volume of the passes should be diminished in the same proportion to cause a uniform flow. The relation between the area of the various passes should be about as follows: First pass about 43 per cent of total heating surface, second pass about 32 per cent of total heating surface, and third pass about 25 per cent of the total heating surface. As the width of the gas passage is uniform, the necessary reduction in the volume of the passes is made by reducing the thickness of the gas stream about as follows: In first pass from 100 to 68, second pass from 68 to 52, and third pass from 52 to 50.

PROPORTIONS OF SOFT AND HARD COAL TO BE USED

Size of Coal	Draft	Per Cent Soft	Per Cent Hard
No. 1 Buck.	Forced	30	70
	Natural	40	60
No. 2 Buck.	Forced	40	60
	Natural	50	50
No. 3 Buck.	Forced	50	50
	Natural	65	35
No. 4 Buck.	Forced	65	35
	Natural	80	20

It is extremely important in burning the steam sizes of anthracite to provide against a large excess of air to the fire. The ideal way to burn this fuel is to use under-grate draft and to throttle the uptake damper to a point where the volume of air will be reduced to a minimum for proper combustion. The necessary pressure for penetrating the bed of fuel is supplied by means of the blower, and the volume is regulated by means of uptake damper. With this equipment an automatic regulator should be connected for the purpose of controlling the draft in accordance with steam requirements. All of this is ordinary standard equipment which may readily be obtained for the purpose.

The boiler setting, of course, should be made tight and kept tight. The draft or "suction" over the fire should be kept as low as possible; under ordinary conditions this should run between 0.10 in. and 0.25 in. (2.54 mm. to 6.3 mm.), water gage.

CAST ROTOR WINDINGS FOR SQUIRREL-CAGE MOTORS

Eliminating Welding Between Bar Windings and Short-Circuiting Rings, They Insure Uniform Cross-Section and a Perfect Union

Casting the bars and short-circuiting rings which comprise the induction-motor rotor windings in one operation is the radical development now being applied by one motor manufacturer. This cast winding insures uniform cross-section and perfect union between the bars and end rings, thus ending previous operating difficulties that arose from their opening. Better balance, greater rigidity and increased durability are also obtained by this new process.

Ventilation for either direction of rotation is obtained by means of a series of holes bored radially through the cast end rings. Freedom from blow-holes and other imperfections is secured through spiral casting and machining methods.

The method of casting the rotor winding is particularly interesting because it is done in place. That is, the stripped rotor serves as the mold in which the bars are cast, thus simplifying construction and minimizing expenses.

OBLIGATIONS OF ENGINEERS IN CIVIC AND SOCIAL AFFAIRS

Need of Their Interest and Participation in Solving Social Problems Voiced at Boston Banquet of Engineering Profession

The engineer's opportunity to aid in solving the present social problems of the world and his duty in reconstruction effort were emphasized at the tenth annual engineers' dinner in Boston April 2, which was attended by about 350 members and guests, representing all branches of the profession. Richard H. Rice, acting manager Lynn Works, General Electric Company, was toastmaster, and among the speakers of engineering note were Henry I. Harriman, president Boston Chamber of Commerce and New England Power Company; C. A. Adams, president American Institute of Electrical Engineers; James J. Storrow, former fuel administrator for New England; Leonard Metcalf, president Boston Society of Civil Engineers, and Prof. George F. Swain of the Harvard Engineering School. George H. Moses, United States Senator from New Hampshire, also spoke on "A League of Nations."

Mr. Rice emphasized the vital need of applying engineering methods of analysis to the social and economic problems of the day. Disaster lies, he said, in failure to acquire a sound knowledge of these questions. Political forces and laws are susceptible to exact study. The world's habit of thought is too often to-day along lines exactly opposite those the engineer follows, and such lines heedlessly followed lead to barbarism. The speaker cited the evil days upon which Russia has fallen and the dangers of restricted production and excessive demands by labor in England as examples of neglecting the careful and just methods of attacking economic and social problems which are peculiarly those of the engineer. The engineer must point out and resist wrong demands, direct efforts in the proper channels and influence public opinion through his potent members along constructive lines.

President Adams urged engineers to study the problems of non-employment and industrial discontent with open minds. In far too many cases the engineer takes little or no interest in such matters or else holds prejudiced views. Behind the prevalent unrest, the speaker said, may be lessons worth learning—better ways of doing things and of improving human relations. Misuse of power has caused trouble, and this must be frankly acknowledged and remedied. A fresh outlook can be brought by the engineer to these difficult affairs, often leading to improvements of an almost revolutionary character which will mean that the engineer serves society in a broader way.

President Harriman touched upon the obligations of America to her allies in reconstruction, in view of her comparatively light losses in the war, and the opportunity of the engineer in this great task. Mr. Storrow paid a high tribute to the coöperation of the engineering profession in fuel saving and urged a closer relation between the engineer and the banker in future, as an aid to the more efficient investment of the people's savings. Professor Swain recounted his impressions of France in his recent trip as a member of the engineering commission from America.

INTERCONNECTION OF TWO ARIZONA SYSTEMS

Seventy-Mile Transmission Line to Connect Pacific Gas & Electric Company of Phoenix with Arizona Power Company

INTERCONNECTION of the generating stations of the Pacific Gas & Electric Company of Phoenix, Ariz., and the Arizona Power Company, Prescott, is to be made through construction of a transmission line 70 miles long. An issue of $300,000 of one-year notes has been sold by Bonbright & Company, Inc., New York, to provide the necessary funds for this improvement and for other additions and betterments. An additional $200,000 in notes of the same issue may be put out. The notes are dated April 15, 1919, bear 7 per cent interest and were offered and sold quickly at 99. At that figure the yield to the investor was over 8 per cent.

The interconnection was arranged to meet the needs of the Arizona districts served by the two companies, which are owned in part by the same people. F. S. Vielé, of New York and Prescott, president of the Arizona Power Company, is vice-president of the Pacific Gas & Electric Company of Arizona. G. H. Walbridge of New York is president of the latter company. The territory served includes mining districts and great irrigation projects. The demand for power has increased, and the districts served have shown substantial progress. It is anticipated that further development will be hastened by provision of additional power facilities.

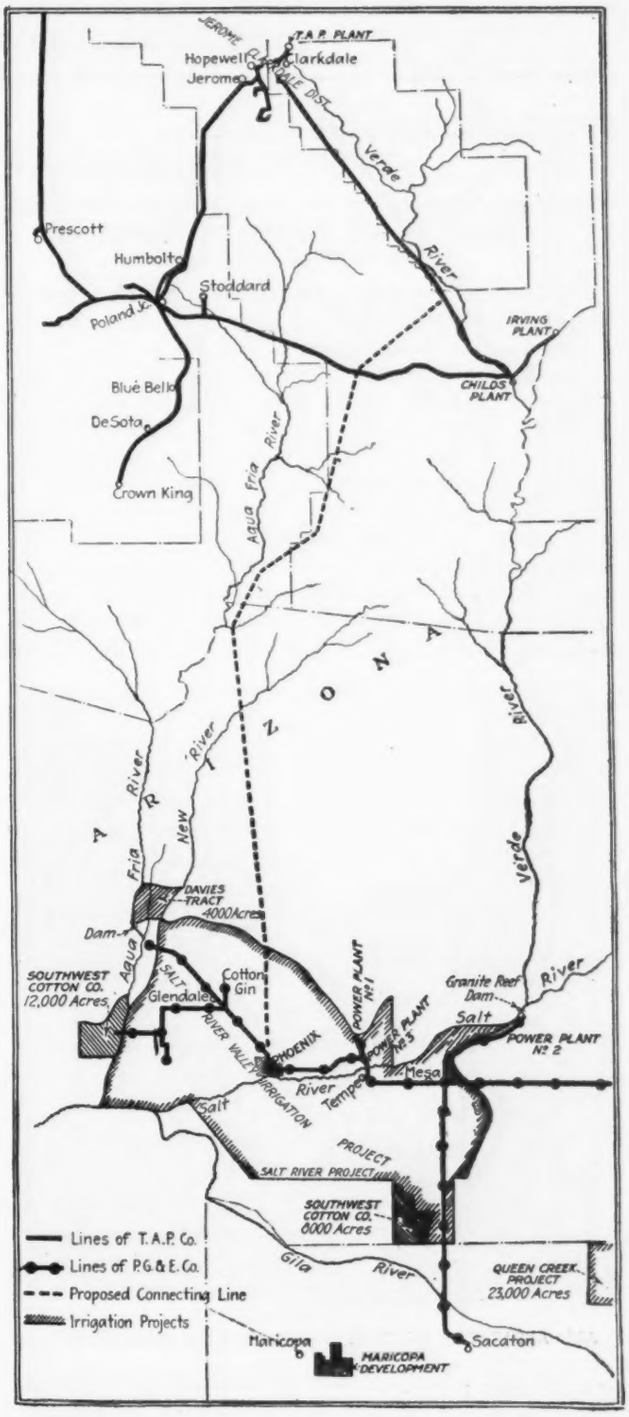
The map on this page, which was obtained from Mr. Vielé in New York last week, gives some indication of the districts reached by the two properties and of the value of interconnection of the systems.

The Pacific Gas & Electric Company furnishes electricity and gas in Phoenix and tributary territory. Its power is obtained chiefly from the Salt River Valley Water Users' Association, which operates the Salt River Valley project of the United States Reclamation Service (Roosevelt Dam). The contract under which this power is secured extends to August, 1926. Connection with the Arizona Power Company will furnish a large additional supply of cheap power. There is a large demand for more power in and about Phoenix, and additional power is not obtainable from the Roosevelt Dam.

The Roosevelt irrigation project, operated by the Salt River Valley Water Users' Association, provided irrigation water for 205,615 acres of land in 1918. The crops from this acreage, including fruits, aggregated $18,200,000 in value, of which cotton and seed alone (50,000 acres) sold for $7,854,000, or a yield of $157 per acre. New land projects with a total acreage of over 100,000 will be dependent on pumping for the necessary water supply. The possibilities for the further use of electrical energy in the territory are therefore most promising.

Both steam and hydroelectric stations are operated by the Arizona Power Company.

This interconnection is a logical development in keeping with the trend of practice throughout the country. It arises from a growing appreciation of the importance of conservation of energy and its sources. The benefits obtainable in this instance from the construction of 70 miles of transmission line call attention anew to similar possibilities in other districts where two plants can be interconnected. Generation of part of the power from hydroelectric systems gives a special advantage which is not found in every possible case where coördination of the plants will improve load factor and lead to economy in fuel.



MAP SHOWING INTERCONNECTION OF TWO ARIZONA SYSTEMS

In this interconnection of Arizona power systems a new example of the value of coördination is presented for the industry. The connection of the systems will provide more power for industrial and mining districts and particularly for the great irrigation projects in that section of the country. Interconnection was facilitated by the fact that there was, in part at least, common ownership of the two companies. The interconnection by construction of 70 miles of line meets an immediate and urgent demand for power in essential industries.

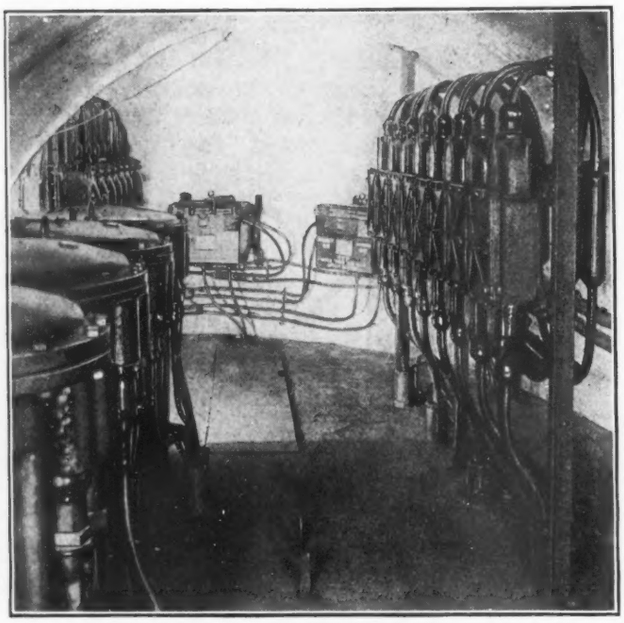
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SUBSTATION WITHSTANDS FLOODS PERIODICALLY

Watertight Connections to Transformers, Fuses and Switches Permit Submerging Without Jeopardizing Service

Underground substation installations which are capable of withstanding flood conditions without damage to apparatus or interruption of service have been developed by the Duquesne Light Company of Pittsburgh to meet a long-felt need. Previously the service to downtown customers fed from certain sections of the underground system was periodically interrupted, whereas now it is unaffected by the stage of the Monongahela and Allegheny Rivers. These substations, which have fairly large transformer capacity, have supplanted small individual transformer installations to a great extent and are usually installed under sidewalks. No attempts have been made to render the vaults waterproof, as the floods frequently rise several feet above



ALL APPARATUS IN THIS SUBSTATION IS WATERTIGHT

the sidewalks anyway. Instead, the wiring, switches, transformers and cut-outs are so inclosed individually that no deleterious effects have been caused even by complete submersion, which has happened twice since this type of installation has been employed.

Lead-covered cables are used for both primary and secondary services and for connections between switches, fuses and transformers in the substation. Enough of the lead sheath is removed from the cable to permit the connections to be made inside the apparatus. The cable is then pushed through a tinned brass thimble, which is wiped to the sheath of the cable. These brass thimbles are fitted to the apparatus in different ways. In the transformers they screw into the case; in the primary cut-outs they are in two parts, one being rigidly connected to the case, while the other part is wiped on to the cable, and the two are connected by means of a pipe union. The lead-covered cable connections between disconnecting switches, transformers, etc., are run in conduits underneath the floor. This conduit is laid on a bed of crushed stone and drilled to allow water to drain out. The substation has always been warm enough to keep water from freezing.

The air vents of the transformers are closed with a pipe plug. As this permits the transformers to be operated at only about 75 per cent of their rating, it is the intention ultimately to connect the vent hole of the transformer to a system of piping which will also vent the primary fuse blocks.

The cast-iron fuse boxes behind the transformers and the disconnecting switch boxes to the right in the picture have rubber gaskets placed under the covers, which are bolted firmly in position. The operating handles of the oil switches are removed when not in use, the holes are plugged up, and the handles are used as a wrench to remove the plugs when necessary.

This information was contributed by P. Conran Petersen of the distribution department.

REDUCING MAINTENANCE EXPENSE BY FREQUENT PLANT INSPECTION

Men Responsible for Operation of Equipment Also Made Responsible for Cleanliness and Maintenance —Inspections Checked by Competent Men

As it is of utmost importance that steam-plant maintenance expenses be reduced to the lowest level possible, inspection of equipment should be made frequently and thoroughly by the men in charge of its operation and care. These inspections should be checked by some competent men both before and after each repair job is done on such equipment to insure against poor work. Some of the rules laid down by the engineering department of the Consumers' Power Company of Michigan to this end are as follows:

Have the cause of all unnecessary noise and vibration eliminated as promptly as possible after it is discovered.

Keep all parts of the equipment subject to rusting, pitting, corrosion, etc., covered by the proper kind of protective coating; avoid unnecessary dampness and corrosive gases such as sometimes escape from the boiler settings on account of improper damper and furnace management; also avoid unnecessary exposure of the equipment to the weather where such exposure will cause deterioration.

Avoid the operation of apparatus not in good condition until it has been properly repaired, when such operation would result in inefficient operation or increase the extent of the repairs required.

Do not allow unskilled. careless or incompetent workmen

to make repairs that require efficient, thorough, capable mechanics for their prompt, correct and economical completion. Require the engineers, oilers, firemen and other operating men to make all such repairs and adjustments so that the habit will be established of each man doing what he can to keep the time of repair crew at a minimum on each part of the maintenance work.

Use foresight in anticipating repair work and in planning and carrying it on.

When it is discovered that repairs are necessary for any part of the equipment, find out just what causes led up to the necessity for these repairs. Think of means within control that will eliminate or modify these causes and prevent or reduce the extent or frequency of such repairs in the future. Discuss the causes and means for correcting them with the men who operate and repair the equipment with the purpose of making them understand the trouble and its causes so they will coöperate in reducing such repairs in the future. Encourage the men to make suggestions that will result in better care, operation and maintenance of the steam-plant apparatus.

SYNCHRONOUS MOTORS IN THE WORKING OF BRASS

Power Requirements of Rolling Mills in the Brass Industry Where the Trend Is Toward the Use of Synchronous Motors

There is an increasing tendency to use synchronous motors for brass rolling mills and especially for the finishing mills where two or more stands are driven by one motor. The power requirements of each stand of rolls in a sheet brass mill are about as shown in the accompanying table:

Operation	Roll Size	R.P.M. of Rolls	Hp. per Stand
Breaking down cast bars.	20 in. to 24 in. by 36 in. (50.8 cm. to 60.9 cm. by 91.4 cm.).	75 to 100	300 to 750
Running down.....	18 in. to 20 in. by 36 in. (45.7 cm. to 50.8 cm. by 91.4 cm.)..	125 to 250	200 to 400
Finishing.....	10 in. to 20 in. by 36 in. (25.4 cm. to 50.8 cm. by 91.4 cm.).	150 to 250	75 to 200

Mill motors are usually geared to the roll shaft; flywheels are not recommended because the metal is pushed into the rolls almost end to end and the load variations are consequently slight.

These facts were brought out by W. R. Clark of the Bridgeport (Conn.) Brass Company in a recent paper which he read before the Association of Iron and Steel Electrical Engineers.

MILL DRIVE IS UTILIZED TO MOVE RAILROAD CARS

Counter Shaft Extended Through Wall Provides Drum for Pulling Cars Into Position for Unloading When Engine Is Not Available

In a flour mill where it is necessary to unload grain from railroad cars at several doors and to load the finished product at different points on the warehouse platform some difficulty is encountered in moving the loaded or partly loaded cars back and forth on the switch when an engine is not available. This problem has been solved in an ingenious manner at the Pasco (Wash.) Flour Mills Company. A countershaft was belted to the main shaft in the mill, which is driven by a 40-hp. Westinghouse motor, and extended through an aperture in the wall of the mill adjacent to the loading platform. Attached to the end of the counter shaft is a steel drum which can be employed in conjunction with a coil of 1.3-in. (3-cm.) rope to move the cars. To move the cars away from the drum or winch, a pulley can be attached at a point beyond where the car has to be and the cable looped back on itself.

From this drum a power scoop is also operated which unloads bulk wheat into the elevator hopper, unloading 1200 bushels (420 kl.) per hour. Two men are all that are required to operate the scoop when using this drum, whereas it formerly took six; furthermore, the drum has increased the unloading capacity from four to six cars a day.

ELECTRIC FURNACE ECONOMICAL FOR MAKING STEEL CASTINGS

Has Revolutionized Steel-Foundry Practice by Allowing Necessary Speed—Superheats Steel to Any Desired Temperature

The electric furnace has lately become the most economical means for producing suitable steel for castings, said W. E. Moore before the Pittsburgh branch of the American Electrochemical Society recently. He also pointed out that in steel-foundry practice speed is specially important, because, with heats required so close in succession, a smaller furnace can be used for a given foundry capacity, thus enabling the required tonnage of castings to be produced with a lighter crane, ladle and building, less floor room and a smaller set-up of molds. For the same reasons the steel can be poured off more rapidly, so that there is less loss by skulling of the ladles and by "miss-run" and "cold-shut" castings, thus increasing the yield. With the electric furnace it is easy to superheat the steel to any degree desired without any "hit or miss" rule so that small, thin castings are commercially possible.

Since the atmosphere in an electric furnace may be readily maintained in a reducing condition no oxidation of the charge takes place during melting, and it is possible to melt thin, light scrap, such as iron turnings, which in the converter or open-hearth process would be reduced to oxides to a large extent. The melting losses in the electric furnace are far less than with any other process, usually running about one-half to one-third of the loss in the open-hearth process and about one-sixth to one-eighth of the loss in the converter process.

Electric furnace steel, when made to meet any specific chemical requirements, is always better than other steels. Usually such steel will run 15 per cent or better in tensile strength or in ductility, depending upon its heat treatment. Furthermore, it is easier to control the chemistry, and consequently electric steel can be made to more accurate specifications than other steel.

The following is typical operating cost (no overhead included) data for melting a 3-ton rapid-type electric foundry furnace, in continuous operation, melting heavy steel turnings and superheating the steel to a fluidity suitable for small steel castings:

MELTING STOCK	
1 ton heavy steel turnings—"axle turnings"	$12.00
1/20 ton (5 per cent) loss in melting "axle turnings"	.60
Electric power, 550 kw.-hr., at 1 cent	5.50
Electrodes, carbon, 20 lb., at 9 cents (Ante-bellum price 4½ cents)	1.80
33 lb. of mill scale (used as a decarbonizer)	.09
ADDITIONS	
8 lb. 70 per cent ferromanganese at 10 cents	.80
5 lb. ferrosilicon at 5 cents (Note that Spiegel and 20 per cent ferrosilicon may be substituted at lower cost.)	.50
½ lb. aluminum	.17
LABOR AND MAINTENANCE	
Wear and tear on refractory roofs and linings at 40 cents per ton (some of our users average 20 cents per ton)	.40
Furnace labor	1.00
Total cost of liquid steel in the ladle	$22.86

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

LAMP SHIPMENTS BY MAIL

Pittsburgh Company Replaces Any Lighting Units Which Are Found Defective on Their Receipt

Incandescent lamps are now being sold by mail by the Duquesne Light Company of Pittsburgh. Upon receiving a telephone call or postal card lamps will be delivered by return mail and the charge placed on the next energy bill.

Broken lamps, if returned immediately, will not be charged for. It seems that the Post Office Department will not insure lamps, so that the company will replace any lamps found defective.

UTILITY MAKES 19 PER CENT ON INVESTMENT IN APPLIANCES

Chart Shows Expenses on Sales of $425,000 Worth of Electrical Devices Made by Western Lighting Company

There is ample evidence that the central station can conduct a retail sales department and sell a large volume of goods at an actual merchandising profit without the necessity of cutting prices or following unethical practices which react against the dealers, according to T. W. Simpson, Western district manager of the Federal Sign System (Electric) before the convention of the Pacific Coast Section of the National Electric Light Association. The outcome of such a condition in a Western city, covering the sales results of ten months ended Dec. 31, 1918, and involving the sale of about $425,000 worth of appliances, was as follows:

	Per Cent
Cost of goods	71.14
Cost of installations	3.49
Total sales expense	5.61
General expense	7.8
Fixed charges	3.75
Net profit	8.16
Selling price	100.00

This central station figures on an average of slightly more than two turnovers of invested capital yearly in the sales department, so that the net profit is not far from 19 per cent on the investment. The table covers all rent, advertising, collection expense, discounts, apportionment of depreciation, executive salaries, etc., and is the result of very careful accounting practice by one of the largest corporations in the country.

"The selling expense," it was stated, "is exceptionally low on account of the weight of authority of the central station. People regard their power company as an oracle on electrical matters and feel that they will be well cared for in their dealings. Every one paying a bill, filing a complaint or ordering a service must pass through the display room, thus creating at no cost a select clientèle which can be reinforced by specialty sales methods of various sorts. The collection expense is very low because the machinery for collections already exists and the extra cost of collecting appliance installments is almost nil. Most important of all, the central station is bound to make a success of appliance selling because the utilization of the devices is wrapped up with its general electricity supply business. The central station has something else at stake besides merchandising profit."

FLAT-RATE CONTRACT IN NORTHWEST STATES

Rate Based on Not Less than 25 per Cent Increase Over Previous Year's Payments, with Mininum of $18 per Annum

A flat-rate system used by the Washington Water Power Company of Spokane, Wash, has served to increase the company's revenue considerably. This rate is optional for such lighting and socket appliances as the consumer may desire, having a demand not exceeding 660 watts, provided that no appliance shall be used for water, air or room heating.

The rate is arrived at on a basis of the consumer's previous year's payment for energy, being not less than 25 per cent increase per annum as shown by the ledger record of the previous year. This is payable monthly in advance. If paid yearly in advance, the customer receives an 8 per cent discount. In any case, however, the net amount shall not be less than $18 per annum. The term of this flat-rate contract is continuous for one year.

CANADIAN RAILWAY COMPANY INAUGURATES LOAN SCHEME

Fifty Thousand Dollars Placed at Disposal of Employees at 6 per Cent Over a Term of Twelve Years

In order to assist its office employees to build or acquire homes during the present scarcity, the British Columbia Electric Railway Company, which supplies electric light and power service to the Vancouver region, has placed $50,000 at the disposal of the office employees' association of the company to be loaned at 6 per cent over a term of twelve years. The scheme is believed to be one of the first of its kind to be launched in the province, and it is already being gladly accepted by the company's employees.

"The reason for making the proposal," said George Kidd, general manager of the company, "was to relieve, as far as possible, our employees from the pressure of high rents, give them homes of their own and thereby induce thrift and interest in the community. Many of them have been inconvenienced, as have others, by having the homes they rent sold over their heads. Many others feel that paying out rent year after year

without a permanent interest in their home is not profitable.

"Some of our employees already had lots but had not the wherewithal to build on them unless at high rates of interest, which would make the monthly charge for principal and interest much heavier than rent. It was these that we hoped to help, and in view of the need for more houses we expect that the plan will induce some of our employees to build."

The disposal of the fund has been placed in the hands of a joint committee composed of representatives of the office employees' association and the management of the company, and the $50,000 has already been allotted by the committee.

RECORD OF SMALL-TOWN RANGE ACCOMPLISHMENT

Kansas Municipal Plant in Town of 4000 Has Forty Domestic Electric Cooking Services Installed

An excellent example of what can be done in a small town with the electric range is given by the Beloit (Kan.) Light and Water Department, of which F. A. Darst is superintendent. This town has a population of more than 4000 people, with 925 electrical customers, and has in the neighborhood of forty electric ranges on the lines of its municipal plant. This is a part of the effort of the Light and Water Department to build up a day load.

In order further to stimulate the range business, the department ran in the local paper a half-page advertisement, here reproduced, showing the monthly energy consumption and bill during 1918 of each of the thirty-six ranges in service during the year. The monthly average, as shown by the table, for all domestic users of energy was $6.95. The rates are 11 cents per kilowatt-hour for the first 3 kw.-hr. used per room per month and 4 cents per kilowatt-hour for the remainder used. A discount of 10 per cent applies on bills paid prior to the tenth of the month.

This department is making a strenuous effort to get all of this business it can, and, in line with this effort, it expects to cut part of its rate to 3½ cents and probably to 3 cents per kilowatt-hour during the summer of the present year.

In addition to this domestic load, the domestic-science department of the high school is equipped with several hot plates and the Kansas Industrial School for Girls, in Beloit, has ten two-burner hot plates in use. There is one restaurant in Beloit that does all of its cooking with electricity, and there is a bakery using it to a large extent. These examples of range efficiency naturally will tend to bring in additional customers.

Electricity A Cheap Fuel in Beloit

Average cost for Cooking, Lighting, Laundering and Household Appliances $6.95 per month for year 1918

The Beloit City Light and Water department having made many big improvements in its plant, is anxious that there be an additional day time consumption of electricity and believes that if the people of Beloit realized the utility and cheapness of electricity for cooking purposes, there would be a more general use of electric stoves. For the purpose of giving this information, and hoping by securing increased day time consumption to reduce electricity rates, a complete record has been compiled showing the consumption and cost per month for each home in Beloit where an electric cooking stove is used. This includes electricity used for stoves, lighting, laundering and other electrical appliances. The city does not sell stoves, but Supt. F.A. Darst will be pleased to give further data or information to anyone comtemplating the use of an electricstove

The complete record for the year 1918 follows. Read it, study it, figure out the cost of your lighting and cooking by other methods, and see if you aren't surprised at the cheapness of electricity, in addition to the many other advantages of electricity. *SAFE—* *CLEAN—* *SURE—* *ECONOMICAL—*

Residence Electric Rate for Lighting and Cooking. 11c per K.W.H. for the first three K. W. H. consumed per room per month. Balance at 4c per K. W. H.

Cost includes Electric Lighting, Cooking, Laundering and other Household Appliance consumption. Covering year 1918.

Consumer	No. of Rooms	January		February		March		April		May		June		July		August		September		October		November		December		K.W.H. Used During Year	Average No. Consumption	Average Monthly Cost
	Number	KWH		KWH		KWH		KWH		KWH		KWH		KWH		KWH		KWH		KWH		KWH		KWH				
1	7	181	$ 8.71	155	$ 8.09	150	$ 7.47	174	$ 8.43	156	$ 7.67	153	$ 6.75	158	$ 7.79	148	$ 7.30	167	$ 8.35	194	$ 9.63	177	$ 9.55	151	$ 7.51	1,926	160	$ 8.69
2	6															52	4.54	132	6.46	147	7.14	128	6.25	121	6.10	608	121	6.12
3	10	216	14.74	201	10.14	219	10.80	249	11.70	194	8.66	183	8.42	199	8.72	207	10.39	290	10.10	245	11.90	196	10.02	185	9.62	2,518	209	10.41
4	6																							67	3.94	67	67	3.94
5	7	114	9.04	157	7.96	150	7.63	157	7.94	154	7.84	147	7.36	159	8.04		1.60	264	12.84	223	10.30	201	9.72	168	8.60	2,054	171	8.44
6	8	334	15.04	239	11.24	251	11.72	154	7.94	165	8.23	169	8.44	57	3.32	45	2.85	245	11.40	229	10.84	204	9.84	193	9.40	2,490	217	10.37
7	9	92	6.57	103	6.01	83	5.51	97	6.77	72	4.77	73	4.81	226	10.12	197	9.84	74	4.55	69	5.45	89	5.45	67	4.57	939	92	5.19
8	6													91	5.53	69	4.23	74	4.01	33	2.37	55	3.25	55	3.25	310	63	3.18
9	6																	109	5.62	104	6.42	33	2.54	46	2.89	291	73	4.17
10	8	486	19.32	366	18.32	377	16.75	402	17.18	303	13.80	314	14.34	372	13.36	228	10.80	223	10.60	253	12.00	254	14.48	254	11.94	3,760	309	14.31
11	9	294	13.95	280	13.09	238	11.29	249	11.49	200	9.59	224	10.85	192	8.57	150	7.19	152	8.17		1.60	601	29.82	215	10.61	2,726	227	11.28
12	12	61	6.16	63	5.12	52	4.60	92	6.29	109	6.88	161	8.98	160	C.52		1.60	73	5.52	236	13.56	155	10.04	154	6.66	1,272	106	6.63
13	3											67	2.95	31	2.82	26	2.93	36	3.13		1.00	46	3.53	3	1.00	225	94	2.76
14	8																							29	2.90	29	29	2.90
15	8	287	13.16	222	10.80	196	9.13	165	8.28	123	6.56	179	8.64	170	8.48	142	7.28	162	8.16	114	6.34	222	10.56	243	15.49	2,324	193	9.43
16	10	275	13.10	236	12.74	222	10.93	134	7.46	170	8.90	195	9.90	15	1.65	236	12.34	325	15.42	175	9.10	193	9.62	193	9.23	2,400	200	10.03
17	7	103	8.59	101	8.51	122	6.32	132	6.75	157	7.78	163	7.99	107	5.75		1.00	102	6.55	124	6.43	124	6.43	105	5.97	1,460	116	6.10
18	8															40	3.23	102	5.76	76	4.72	49	3.23	67	3.96	315	63	4.30
19	6	145	7.06	122	6.54	169	8.02	212	13.74	109	5.62	102	7.74	215	9.86	149	7.23	166	7.90	221	10.10	206	9.60	157	7.54	2,143	174	8.40
20	10	254	12.26	263	12.23	241	11.74	229	14.90	299	14.06	316	14.74		1.00		1.00	445	20.06	130	9.90	125	7.10	124	7.37	2,427	213	9.96
21	9	154	8.05	148	7.81	164	8.25	236	11.33	222	10.77	292	13.57	230	17.09	236	14.33	230	13.09	276	12.89	252	11.97	201	12.93	3,050	254	12.06
22	8	255	9.06	155	7.68	190	8.68	194	8.24	153	6.80	131	6.92	125	7.88	166	8.23	129	6.84	174	8.64	144	7.44	149	7.69	1,794	149	7.66
23	5	7	1.00	85	3.25	78	4.17	17	1.73	52	2.35	184	8.41	158	7.37	163	7.53	163	7.57	155	7.25	126	6.09	83	4.83	1,219	101	5.09
24	6	129	6.32	89	5.22	102	5.30	113	5.78		1.00	111	6.78	113	5.78	9	1.00	91	6.90	25	2.30	137	6.74	122	6.14	1,152	97	5.06
25	10	110	6.36	110	6.50	74	5.06	93	5.82	67	4.78	124	7.46	85	4.30	264	16.06	194	6.36	102	6.12	92	5.32	119	6.66	1,474	118	6.31
26	5	112	5.51	123	6.17	84	5.61	110	5.45	92	4.73	108	5.57	11	1.71	105	5.25	67	3.73	104	5.31	100	5.80	90	5.01	1,100	91	4.89
27	7	166	8.11	206	13.71	322	14.29	261	12.99	189	9.03	237	10.15		1.00		1.00		1.00		1.00		1.00	325	14.47	1,814	151	7.52
28	7	102	5.55	89	5.03	81	4.73	99	5.43	73	4.39	69	4.32	67	4.15	63	3.79	71	4.31	130	6.27	105	5.67	96	5.31	1,039	86	4.90
29	7	46	2.23	46	2.31	26	2.01	63	2.99	20	2.67	267	11.75	222	10.35		1.00	95	5.27	170	8.27	69	3.97	73	4.31	1,064	89	4.98
30	10	117	6.78	115	6.70	128	7.10	134	7.46	125	7.10	163	8.62	114	6.66	26	2.86	154	8.26	149	7.90	149	7.70	179	8.90	1,535	127	7.17
31	6	155	8.68	145	7.96	136	6.70		1.00		1.00	208	9.50	72	4.10	50	3.28	2	1.00	63	4.58	178	8.88	159	7.68	1,215	101	5.24
32	4			253	11.38	93	4.73	111	5.70		1.00	310	13.06	117	5.94	106	5.50	183	8.54		1.00	224	10.32	169	8.02	1,500	180	6.93
33	6	104	5.42	104	5.42	103	5.30	126	6.30	113	5.78	157	7.54	109	5.63	145	7.06	129	6.42	153	7.34	210	9.66	113	5.79	1,565	130	6.48
34	11	51	3.41	46	4.15	27	2.97	37	2.79	25	2.75	110	6.71	148	8.23	171	9.15	158	7.83	30	2.30	21	2.31	34	3.07	868	72	5.02
35	8							308	13.93	256	11.82	234	11.04	207	9.76	163	7.66	239	10.84	236	11.13	266	16.32	227	10.76	2,200	245	11.37
36	6									60	3.05	93	3.61	71	3.39	51	3.09	72	4.17	46	3.65	69	3.81	73	4.17	531	66	3.65
																									Totals	63,540	4,857	$660.10

$6.95—Average Monthly Cost per Consumer.

135 K.W.H.—Average Monthly Consumption per Consumer.

DAILY CALL PRINT, BELOIT, KANSAS

MONTHLY RECORD OF ENERGY CONSUMPTION OF THIRTY-SIX CUSTOMERS USING ELECTRIC RANGES

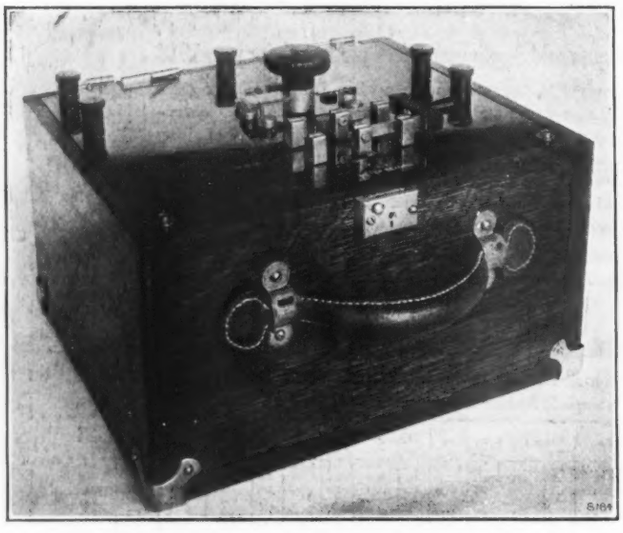
TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Operation of Alternators in Parallel.—M DE MARCHENA.—In this paper, presented before the French Society of Electricians, the author treats the synchronizing torque from a new point of view, studies the influence of amortization upon the conditions of resonance and calculates the period of two groups of electrical machinery operating in parallel, concluding that the groups should be of such a kind that their free oscillations will have a periodicity lower than that of the lowest harmonics of the motor torque. The alternators should have a powerful amortiser circuit; otherwise the amortisers complicate the construction without giving effective results.—*Revue Générale de l'Electricité* March 15, 1919.

Meter for Testing Generator Wave.—A very ingenious portable instrument has been developed through the efforts of the A. I. E. E. committee on telegraphy and telephony, as described by Dr. H. S. Osborn at the recent midwinter convention and reported in the ELECTRICAL WORLD of March 1. The presence of harmonics, in generator waves, of frequencies obnoxious to telephone systems, is determined by very simple manipulation of the instrument shown. It is thus used to find the "telephone-interference factor" of a generator wave. —*Proceedings A. I. E. E.*, February, 1919.



PORTABLE TELEPHONE-INTERFERENCE FACTOR METER

Kind and Characteristics of Motor.—E. ADLER.—Comparatively few compound direct-current motors are used in Germany, but the number of these machines with commutating poles is likely to increase. Lack of a standard ratio of compounding has been a check on utilization of these motors. Speed variation and other mechanical characteristics should be studied more closely, particularly by makers of machines in which the resisting torque is a function of speed. In general there are far more combinations of power and speed than are required and more than are justified by the accuracy with which the power consumption of the load is known. The author discusses at length the rating of motors which are to be used on intermittent load. Standardization of motors for cranes and steel works would do much to simplify design and construction of the driven machines. Belt drive is usual and offers many advantages. An idler pulley (preferably pivoted to the motor frame and sold with the machine) is generally preferable to slide rails in the case of small motors. There is necessarily a considerable variety in the general arrangement of bearings, shaft direction, seatings, etc. Steps should be taken to define and restrict the degrees of inclosure. Ventilated, protected motors are the most widely useful class. Closely allied to the question of inclosure is that of the insulating material and its impregnation. Standardized construction and arrangement of terminals would be advantageous. The dimensions and capacity of starting and controlling gear should be standardized with a view to eliminating inadequate designs which have been produced as a result of price cutting. The American rules for standard starting conditions (in reference to starter rating) are criticised adversely. It is recommended that starters be rated according to the power of the motor and that distinction be made between light-load and heavy-load starters. In the interests of more frequent utilization of variable-speed motors the highest speed obtainable in direct-current interpole motors by field control should be quoted in price lists. Electrodynamic braking is used to an increasing extent where motors have to be stopped frequently. — *Science Abstracts, Section B*, Jan. 31, 1919. (Abstracted from *Elektrot. Zeits.*, Oct. 3, 1918.)

Lamps and Lighting

Cathode-Glow Lamps for Control.—O. SCHALLER.—For signal and control purposes low-power lamps are wanted. When in neon or neon-helium lamps the anode is brought up to the glowing column, no special striking device is needed on 220-volt circuits, and the pressure may rise to 250 volts without doing harm. The lamps shown are run on direct or alternating current; in the latter case they act as rectifiers, stopping at 150 volts. Lamps of various shapes and sizes with iron electrodes were exhibited.—*Science Abstracts, Section B*, February, 1918. (Abstracted from *Zeits. Electrochem.*, May 1, 1918.)

Calculations of the Performance of Diffusing Reflectors.—J. ONDRACEK.—This article is mainly mathematical in nature and deals with the properties of diffusing reflectors (*i.e.*, reflectors having a matt surface obeying the cosine law). The calculations and formulas developed are designed to determine the nature of the polar curve of light distribution (which in general approaches a circle in so far as the reflecting surface is

concerned) and efficiency. The author bases these relations on the inverse-square law and cosine law without utilizing the conception of flux of light. A variety of reflectors—plane, conical, spherical, etc.—are considered, in some cases allowance being made for the effect of multiple diffuse reflection. In conclusion a typical case is worked out assuming a coefficient of reflection for the material of the reflector of 80 per cent. —*Science Abstracts, Section B,* February, 1919. (Abstracted from *Electrot. u. Maschinenbau,* Oct. 27, 1918.)

Generation, Transmission and Distribution

Water Power and Its Utilization.—The world's present power demand is estimated to be of the order of 120,000,000 hp. (steam, gas and water power), and of this amount 75,000,000 hp. is the estimate for factories, lighting and tramways. This is further split up to show its most probable distribution, and a table is given showing the available and developed horsepower per square mile of area in the various countries. Other sections deal with nitrogen fixation, cost of hydraulic power, resources of Canada and resources of Australia. It is concluded that the potential water power of the empire amounts to at least 50,000,000 to 70,000,000 hp. —*Science Abstracts, Section B,* Feb. 28, 1919. (Abstracted from *Nature,* 102, Sept. 5, 1918.)

Fuel for the Merchant Marine.—F. PARKMAN COFFIN.—The operation of the huge merchant marine now being built in the United States will consume large quantities of fuel. Present plans specify oil for this purpose, but the adaptability of powdered fuel for marine use should be investigated in order to relieve the drain on the nation's limited petroleum reserves. The author gives a comprehensive review of the principal problems involved in connection with the preparation, handling and burning of powdered fuels on shipboard. Among the important advantages of semi-coke are its safety in storage and handling and the fact that it can be made by carbonizing lignite and many low-grade coals, which are more widely distributed than high-grade coals.—*General Electric Review,* March, 1919.

Use of High-Pressure and High-Temperature Steam. —J. H. SHAW.—The greatest difficulty in determining whether or not high-pressure and high-temperature steam can be used efficiently in power stations is the effect of these higher heats upon the steel and iron in the machines. The author gives entropy diagrams which show the amount of heat available at higher temperatures and pressures, and schedules which give these data when pressures of 215 lb., 365 lb. and 500 lb. (15, 26 and 35 kg. per sq.cm.) absolute are used at the turbines. The author says that the source of water for use in high-pressure plants will have to be carefully traced and the treatment of the water should be such that a minimum of insoluble salt remains after treatment. The natural development of the turbine for higher pressures appears to be in line with a Parsons two-cylinder machine with a flexible claw-type coupling between the cylinders and a thrust bearing for each cylinder. A table is given showing the coal consumption, cost of coal and the amount of capital that can be expended to absorb the estimated saving by using high pressure. In order to get a higher over-all efficiency it is necessary to increase both the pressure and density of the steam. An increase in the pressure with a constant temperature would mean that the dew point is carried further up the turbine toward the high-pressure end, thus tending to accelerate blade erosion in the lower stages and a reduced stage efficiency of the turbine. Also the high-pressure blading of a turbine is considerably less efficient than the low-pressure stages, and although the losses in the high-pressure end are partly recovered in the low-pressure blades, it is apparent that to assume that a turbine for extra-high pressure can be built with the same efficiency as one for a lower pressure is taking a hopeful view and that there is justification for hesitation before adopting extra-high pressures.—*Journal of the Institution of Electrical Engineers,* January, 1919.

Traction

Zurich Municipal Railways.—Features of this system of electric street railways are discussed, and the monthly traffic receipts are given for several years in this article.—*Electric Railway and Tramway Journal* (London), Feb. 7, 1919.

Testing Railway Control Equipment.—W. H. PONSONBY.—Since railway equipment is subjected to a continual vibratory motion and at times has to perform its functions under adverse weather conditions, the tests must necessarily be of a very rigid nature. The writer deals with both control wiring and the motor equipment.—*Electric Journal,* March, 1919.

Partial Electrification of a Great Network of Railways.—Synopsis of a report by M. Sabouret, engineer for the Compagnie d'Orléans, on the project of that company to electrify about 3000 km. of its many lines, or 40 per cent of the total. The fulfillment of the program will take fifteen or twenty years. Rotative substations, aërial wires and the use of recuperative energy are three of the elements in the plan. An annual saving of 900,000 metric tons of imported coal will, if the scheme is carried out, be made in 1933, on the supposition of a yearly growth in traffic amounting to 5 per cent.—*Revue Générale de l'Electricité,* March 15, 1919.

Carbon Rubbing Contacts for Electric Trams.—As soon as aluminum became scarce experiments were made in Germany to use other materials, such as zinc, carbon, cast iron and alloys, for the rubbing contacts to collect the current from the overload trolley wires of electric tramways. Aluminum has the great advantage that the trolley wires are not attacked so badly as with other metals. With zinc contacts about 8000 car-miles were attained. Carbon contacts of the original type gave 23,000 car-miles, and the aluminum contacts previously used 10,000-11,000 car-miles. With improved carbon contacts, with provision for lubrication, the very high value of 75,000 car-miles was reached. These contacts gave a high polish to the trolley wires, which contributes to their long life. The grade of carbon used was considerably softer than that generally used in carbon brushes for dynamos. Zinc is unsuitable, owing to its low melting point, which causes it to burn easily so as to leave a rough surface. Cast iron can only be used at the cost of a rapid deterioration of the overhead wire owing to violent sparking. In running tests carbon contacts sparked only intermittently at currents between 120 amp. and 150 amp., whereas aluminum contacts sparked continuously at the same load. Carbon contacts should be pressed against the trolley wire with a pressure of 5 kg. to 6 kg.—*Technical Supplement to Review of Foreign Press.* (Abstracted from *Mitteil. des V. D. Strassenbahnen und Kleinbahnen-Verwaltung; Schweizer. Elektrot. Zeits.,* Jan. 18, 1919.)

Installations, Systems and Appliances

Three-Phase to Two-Phase Transformation.—J. B. GIBBS.—The connections shown for three-phase to two-phase transformation include the ones most commonly used as well as others which are given as suggestions for possible emergency connections even though the exact voltage and phase relation may not be obtained. *Electric Journal,* March, 1919.

Making Paper by Electricity.—A reservoir, penstock and power plant all within a few hundred yards, as well as the factory utilizing the power, the raw materials and the shipping facilities immediately adjacent, are features of a paper mill belonging to the Ocean Mills plant and situated 350 miles (560 km.) north of Vancouver. Two power plants operate the machinery of the sawmill and paper mill. These are fed by two penstocks which deliver the water under a head of 130 ft. (40 m.). Power house No. 1 is a reinforced-concrete building with two Francis turbines and a Pelton waterwheel with a combined capacity of 8850 hp. Power house No. 2 is used as a standby plant with three 600-kw. wicket-gate inward-flow turbines directly connected to three 600-kw. generators. There are about 200 motors in use in the installation varying from 10 hp. to 725 hp. The majority are squirrel-cage induction motors. The process of paper making, indicating the use of these motors, is then briefly described.—*Journal of Electricity,* March 15, 1919.

Solder for Aluminum.—As a result of a study of the composition, use and effectiveness of solders for aluminum the Bureau of Standards has reported the following features: (1) All metals or combinations of metals used for aluminum soldering are electrolytically electronegative. A soldered joint is therefore rapidly attacked when exposed to moisture and disintegrated. (2) Joints should therefore never be made by soldering unless they are to be protected against corrosion by a paint or varnish or unless they are heavy so that corrosion and disintegration of the joints near the exposed surface would be of little consequence. (3) Solders are best applied without a flux after preliminary cleaning and tinning of the surfaces to be soldered. The composition of the solder may be varied within wide limits. Suggested ranges of composition are as follows: tin-zinc solders, tin, remainder; zinc, 15–50 per cent. Tin-zinc-aluminum solders, tin, remainder; zinc, 8–15 per cent; aluminum, 5–12 per cent. (4) The higher the temperature at which the "tinning" is done the better the adhesion of the tinned layer; perfect union between solder and aluminum is very difficult to obtain. (5) The joint between previously tinned surfaces may be made by ordinary methods and with ordinary soft solder. Only the "tinning" mixture need be special for aluminum. (6) There is no reason why a good solder for aluminum need be brittle, as several commercial varieties are. (7) The tensile strength of a good aluminum solder is about 7000 lb. per square inch (500 kg. per sq.cm.), the strength of a joint depending upon the type and upon the workmanship. Much dependence should not be placed on the strength of a joint.—*Circular Bureau of Standards,* No. 78, Jan. 28, 1919.

Electrochemistry and Batteries

Farm Lighting as a Field for Small Storage Batteries.—GEORGE W. HILL.—The author is of the opinion that the best results from batteries should be obtained by using them for light loads and for emergency reserve.—*Electrical Review,* Feb. 22, 1919.

Units, Measurements and Instruments

Measurement of Fluid Velocity and Pressure.—J. R. PANNELL.—One of a series of articles on anemometers especially used for the measurement of air velocity.—London *Engineering,* March 7, 1919.

Improved Form of Throttling Calorimeter.—W. R. WOOLRICH.—When using the throttling calorimeter the data of the test are substituted in a formula or are used in connection with a curve sheet to find the quality of the steam. In this article it is explained how the instrument may be made self-contained by having the necessary curves drawn on a metal plate fastened to the barrel of the calorimeter. Thus, having observed the initial pressure of the steam and the temperature in the calorimeter, the quality can at once be found from the curves which are drawn on the plate.—*Power,* April 1, 1919.

Photometric Apparatus for Measuring Illuminating Value of Fluctuating Sources of High Candlepower.—A. P. TROTTER.—A description of the apparatus and experiments in the measurement of the candlepower of flares and sources of like character. Curves give various candlepowers of these light sources, showing that it is possible to take readings at intervals of two seconds.—*Illuminating Engineer,* November, 1918.

Determinateness of the Hysteresis of Indicating Instruments.—F. J. SCHLINK.—The hysteresis loops obtained in the specified cyclic calibration of a non-integrating mechanical instrument nearly free from transient after-effects at rates of operation obtaining in the experiment are highly reproducible and invariant in themselves, even in the presence of very considerable instrumental friction and the resulting so-called unreliability of indication. The limiting values of the variant errors of such an instrument can be accurately set down upon the performance of a calibration of the type referred to for any given range of operation in question, since the major loop corresponding to that range circumscribes and completely incloses all minor or secondary loops observed over ranges of indication between its own terminal limits.—*Journal of Washington Academy of Sciences,* Jan. 19, 1919.

Miscellaneous

Modern Testing Departments in Factories.—E. PHILIPPI.—An outline sketch of the general arrangement of testing departments for electrical machinery, including the lay-out of the building, sources of current, installation of conductors and switchboards, and types of measuring instruments.—*Science Abstracts Section B,* Jan. 31, 1918. (Abstracted from *Elektrot. Zeits.,* Aug. 1, 1918.

Study of Water Hammer at the Floodgates.—E. CAREY.—In another of the extended series of articles on water hammer it is contended that the curves showing the action of this phenomenon opposite the floodgates correspond to a series of typical curves always encountered which define clearly the general form of water hammer in conduits of constant diameter and thickness. The laws governing rapid closing and openings with respect to water hammer are also studied, and formulas are deduced from those determined by Mich- and for complete closure in $2L/a$ seconds (L being the length of the conduit in meters and a the speed of the propagation of the wave from the water hammer in meters per second) and by de Sparre for slow closing and opening.—*Revue Générale de l'Electricité,* March 8, 1919.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

MORE SPACE LEASED FOR ATLANTIC CITY EXHIBITS

Manufacturers Who Wish Space Can Be Taken Care Of if They Notify Exhibition Committee of N. E. L. A. at Once

By immediate notification manufacturers can still obtain space at the exhibition to be held in connection with the N. E. L. A. convention at Atlantic City, according to H. G. McConnaughy, secretary of the exhibition committee.

"About 5000 sq.ft. additional space has been leased," said Mr. McConnaughy to a representative of the ELECTRICAL WORLD. "This is a continuation of the space already provided. This year the exhibition is ideally located because the delegates will pass through this room on their way to the meetings. Furthermore, the prize contest announced last week is bound to stimulate interest in the exhibits and cause the delegates to study carefully everything being shown."

The exhibition committee will move its headquarters to the Million-Dollar Pier, Atlantic City, on May 1. All communications to it should be addressed there from that date.

It Is the Victory Loan

MUNICIPAL UTILITIES ARE SUBJECT TO REGULATION

Illinois Supreme Court Holds that the Section of the Act Which Exempted Such Properties Is Unconstitutional

The Illinois Supreme Court has rendered a decision that municipally owned public utilities come under the jurisdiction of the public utilities act and that Section 10 of the act, which exempted such properties, is unconstitutional. It reversed the finding of the lower court in the case of the Springfield Gas & Electric Company against the city of Springfield.

Extracts from the decision follow:

In operating an electric light plant and selling electricity to individauls the city is not exercising its governmental powers but its private or proprietary rights, and its duties and liabilities are the same as those imposed by law upon individuals engaged in the same business.

There is no doubt that the exception of municipalities owning or operating public utilities from the operation of the public utilities act, which applies to every other corporation, company, association or individual, grants to such corporations a special privilege which such other corporations do not enjoy and is therefore obnoxious to the provision of the state constitution against special laws unless there exists some reasonable basis, having reference to the object of the legislation, for placing such municipalities in a class by themselves.

The persons who use the products or service of public utilities are entitled to the benefit of the public utilities act and are entitled to its protection against extortion, discrimination and inferior service, by whomsoever furnished. The furnishing of such service is an ordinary commercial business by whomsoever undertaken. Whether a public utility is owned by a private corporation or a municipal corporation, its relation to its customers is not different. They are under the same compulsion to use its service, are at its mercy to the same extent. If a customer is oppressed by extortionate charges or discriminated against by a wrongful rate or inferior service, the wrong is the same whether done by a municipal corporation or a private corporation.

The difference in ownership does not change the character of the wrong done or justify the refusal of a prompt, adequate and complete remedy in one case which is granted in the other. The fact that by organizing with others complaining consumers may be able at some future election to secure a change of administration which will perhaps have the ability and sense of justice voluntarily to correct the wrong does not justify putting municipally owned public utilities in a class separate from other competing public utilities and relieving them from the supervision of the Public Utilities Commission.

Finish the Work—Do Your Part

SETTLEMENT OF THE NEW ENGLAND TELEPHONE STRIKE

Terms on Which Agreement Is Made Between Representative of the Postmaster-General and 20,000 Striking Employees

The strike of New England telephone operators, which began April 15, ended Monday of this week at 3 p.m., following a visit to Boston of First Assistant Postmaster-General Koons, who was empowered by the Postmaster-General to settle the controversy.

About 8000 operators and 12,000 electrical workers in telephone companies, serving all of New England except Connecticut, went out during the past week, and a national strike of telegraph workers was seriously threatened by the continuance of the walkout. By the settlement terms the operators receive an increase, from $8 to $10 per week for beginners, and their maximum pay is raised from $16 to $19 per week. They also receive the right to bargain collectively with the managements of the New England and other companies. Increases of 50 cents per day were granted the men electrical workers in the Boston district, and 62.5 cents per day to those outside.

The agreement was reached after protracted conferences on Sunday between Mr. Koons and the various parties in interest, and it was ratified by the unions at meetings which were held by their members soon after the conferences closed.

You Owe It to Those Who Fought

CALIFORNIA COMMISSION ON THE RECONSTRUCTION PERIOD

Power Is the Foundation of Industrial and Agricultural Development and Money Must Be Raised to Utilize Hydroelectric Energy

Because of the interest displayed in Kern, Tulare and Kings Counties in the petition of the Mount Whitney Power & Electric Company for authority to add 5 per cent to the 10 per cent surcharge on rates it was authorized to collect by the Railroad Commission, the commission has issued a statement telling of the wide range of territory in which the rate question is demanding attention, the aims of the commission, its methods and the results of the regulatory practices of California's utility commission.

In pre-war times the California commission, in its regulatory policy, held that an 8 per cent return on a valuation that represented a true rate-making base was a fair and reasonable one. It was accepted by the utilities and the investors, because they knew it was fair and reasonable, and the rates which gave this return were acceptable to the consumers, the people, for the very same reason—their fairness was obvious. This view of California utility rates is widespread where thought is given the matter. The surcharge of to-day is simply an addition to "fair and reasonable rates" in order that they may be maintained as fair and reasonable rates.

Abnormal conditions are responsible for the surcharge. Every cent of profit on which utilities must depend if they would give service and provide the development that California's growing needs demand disappeared with our entry into the war. Oil jumped in price from 60 cents a barrel to $1.75 and more. Wages advanced as the cost of living soared, and material costs jumped to almost a prohibitive figure. On top of it all were piled war taxes. Absorption of all these increased costs without increase in revenue meant ruin in the utility field, a situation quickly realized in Washington, whose first appeal was to the utility commissions of the various states to see that "utilities functioned properly, that there was no break-down in the forces upon which industry depended."

The surcharge of the California commission preserved the efficiency of the state's utilities, preserved their financial integrity, insured their proper functioning. With other regulations the surcharge aided in keeping California utilities out of the hands of receivers, a record not enjoyed by every state. Not one ceased to function or failed to meet demands that tested it to the limit.

The reconstruction period brings but little change in the situation. The price of oil has not dropped. Wages have not gone down. Taxes are still high and numerous. These three items of expense, largely responsible for the big increase in operating cost, the almost complete disappearance of the public utility profit up to the time of the granting of the surcharge, still remain the utility burden. And with the reconstruction period has come a danger that involves not only the utilities but the state itself. Many of the large utilities have demands for service that cannot be filled with the present facilities. This accounts for the planned construction activities of the state's utilities.

Millions will have to be spent if the state is to take advantage of the industrial and agricultural development that is coming because of changed conditions brought about by the war. Power is the foundation of this development, the cause of it. Steam-generated power, which means the use of oil as fuel, and therefore added cost for energy, is not what is wanted. The state's natural resources must be utilized. The state's development rests upon its hydroelectric energy. California's mountains are filled with it, but it must be harnessed. The harnessing costs money, and this money may be had from investors only as the utilities show that they are sound financially. That they are sound is largely due to wise state regulation.

The consumer is asked to pay only a fair and reasonable rate for service, and the fairness and reasonableness of the rate is determined by a commission whose expert engineers do their own valuation work. Better by far, as California's history of utility regulation shows, an 8 per cent return and good service and sound utilities, with real development, than a return to the condition that prevailed prior to the establishment of regulation, with its cut-throat and ruinous methods and waste and duplications due to competition.

It Is Victory and Liberty Now

REUNION OF THE EUROPEAN TRAVELERS OF 1889 PARTY

Dinner in New York About May 27 by Survivors of Electrical, Civil, Mechanical and Mining Engineering Societies Who Made Trip

Thirty years ago a party of American engineers, with members of their families, belonging to the four national engineering societies—American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers and American Institute of Electrical Engineers—sailed for Europe, visiting England and the Paris Exposition of 1889 and being the recipients of many high courtesies, official, professional and individual.

Plans have been made for a reunion dinner, to be held in New York City about May 27, at which it is hoped that all the survivors, women as well as men, of that memorable trip may meet again. While the records of the various societies furnish an approximately complete list of the party, it is possible that some have been overlooked or that addresses may require correction. It is therefore urgently requested that any one who was of that party communicate immediately with Jesse M. Smith, secretary of the committee, at the Engineers' Club, 32 West Fortieth Street, New York.

This information is desired from every member of the party, whether attendance at the function is possible or not. Those who cannot come will be heartily remembered when their letters are read. It is hoped that the response to this request will be immediate and complete; the time is brief and the information important. Announcement of the precise date and place and full details will be sent to every individual who can be reached. Henry R. Towne is chairman of the committee.

This Is the Last Call—Be Ready

PUBLIC UTILITIES COMMITTEE OF THE CHAMBER OF COMMERCE

Membership of New Organization Created by United States Chamber of Commerce to Study Matters Affecting Public Utilities

The Chamber of Commerce of the United States has created a committee on public utilities. This committee is composed as follows:

Lewis E. Pierson, Irving National Bank, New York City, chairman.
Henry G. Bradlee, president Stone & Webster, Boston.
Arthur W. Brady, president Union Traction Company, Anderson, Ind.
F. B. DeBerard, director of research Merchants' Association, New York.
P. H. Gadsden, Munsey Building, Washington, D. C.
E. K. Hall, Electric Bond & Share Company, New York.
Albert W. Harris, president Harris Trust and Savings Bank, Chicago.
Charles L. Harrison, chief of ordnance, Cincinnati district, Walsh Building, Cincinnati.
J. W. Lieb, vice-president New York Edison Company, New York.
P. W. Myers, president St. Paul Association of Public and Business Affairs.
James S. Havens, Eastman Kodak Company, Rochester, N. Y.

At the annual convention of the national chamber in St. Louis a public utility section will be established. It is expected that the committee will have speakers representing the banking interests, the views of labor, representatives of municipal leagues, mayors of cities and others. After the convention the committee proposes to have public hearings on public utility matters, from which to gather material for a referendum to be sent to the national chamber's membership. Then, it is planned, a report will be formulated by the committee, to be sent to each chamber of commerce throughout the United States, particularly to local chambers of commerce, to enlist the interest of all who desire to work out various phases of public utility problems.

V Loan Stands for Victory Loan

ELECTRIC SYSTEM AT HOG ISLAND SHIPYARD

President M. C. Brush of American International Shipbuilding Corporation Gives Details—Service from Philadelphia Electric Company

Testimony given by Matthew C. Brush, president American International Shipbuilding Corporation, before the committee on commerce of the United States Senate gives interesting data in regard to the electric system at the shipyards at Hog Island. Following are the details:

Power purchased from Philadelphia Electric Company.
Transmission lines, double-circuit steel tower, 66,000 volts; length, 7800 ft.
Main substation, brick and steel construction, placed in service March, 1918; capacity, 24,000 kw.
Substations, 35.
Motors, 1149; combined horsepower, 37,100.
Transformers, 577; capacity, 22,252 kw.
Street and yard lamps, 3441; equivalent in capacity to 66,620 40-watt lamps such as are commonly used in residence lighting.
Building lamps, 200,000 outlets.
Electric fans, 1558.
Pumping stations, 10.
Compressor houses, 7.
Fire-alarm boxes, 409
Consumption, 130,000 kw.-hr. received, transformed and distributed.
Time clocks, 422, synchronized with and operated by master clock at main substation.
Electric yard call, 28 stations.
Miscellaneous: Electric tabulating machines for material control and financial accounts; electrically driven potato peelers, dough mixers, dishwashers and hospital appliances.
Overhead wires, 400,000 ft. Equal to more than 75 miles.
Poles for overhead lines, 500.
Underground cables, 400,000 ft., more than 75 miles.
Fiber duct laid in concrete, 237,600 ft., or 45 miles.
Wire used in lighting permanent buildings, 2,000,000 ft., approximately 379 miles.
Temporary work: Overhead wires strung, 531,000 ft., or 101 miles; poles set, 1052; substations built, 3.

Make a Good Job of It—Buy Notes

Electricity's Part in Chicago's Welcome to Her Returning Troops

The artistic lighting standards on Michigan Boulevard, Chicago, materially reduced the task of decorators who were "fixing up" the city for the Victory Liberty Loan and the homecoming of the Middle Western contingent of the Forty-second (Rainbow) Division. The victory trumpeters, the red, white and blue diffusing globes, the flags and the flower baskets on the standards were only a part of the decorative scheme. In Grant Park, which flanks the boulevard on the east, great parks of cannon from the western front, the Liberty Way and arch of jewels were all arranged so that they could be floodlighted to high intensities at night.

Make the Victory Loan a Success

CONSERVATION OF ENERGY IN GENERATION OF POWER

Dr. George Otis Smith Calls Attention to Economy of Human Energy Through Displacement of Steam-Generated Power by Water Power

In speaking at the meeting of the Engineering Society of Western Massachusetts at Springfield, Mass., on April 16, Dr. George Otis Smith, Director of the United States Geological Survey, supplemented the references that had already been made to the proposal of Secretary Lane for an investigation of the super-power plan. Without touching upon the engineering phases of the plan as developed by W. S. Murray, Dr. Smith referred to the phase of conservation that best meets the present-day need as conservation of energy.

Dr. Smith said that the idea that engineering efficiency is conservation of labor is not novel to engineers, a large purpose in whose profession is nothing more or less than labor saving. When Mr. Murray spoke of displacing steam-generated power with water power and of saving coal in his central stations instead of wasting it in locomotives or local plants, small and out of date, he may have proposed coal economy, but he really had in mind economy of human energy.

Looking back of the coal and seeing the miner and the fireman, Dr. Smith added that every ton of coal saved is one nine-hundredth of the miner's year of toil saved (968 in 1918). The saving of a few ounces (four) of coal per kilowatt-hour reported by the Boston Edison company this year as compared with 1917 thus means saving the work of more than thirty miners back in Pennsylvania and West Virginia, where there was shortage of mine labor. Expressed in transportation, this annual saving of 30,000 tons by one company would mean nearly ten barge loads, or nearly forty trains of one of the coal roads. This is thrift well worth while, if that labor is put to a better use.

The balance sheet of the Alabama Power Company, continued the speaker, shows that the man power required in the steam plant and coal mine tributary thereto is thirteen and one-half men to the 1000-kw. capacity, whereas in the hydroelectric plant of the same company the comparative figure is less than one-sixth of a man.

Industrial New England must plan to safeguard in every way its chief asset, skilled labor, Dr. Smith declared. Just as Emerson said that the civil war had unrolled a map of the Union and hung it in every man's home, so now the great war has unrolled the map of the world and hung it above the desk of every engineer and business man. "We must now think in terms, not of Massachusetts, or of New England, or even North America, but of the whole world," said he.

Dr. Smith then spoke of the preparation of data for the use of the Peace Commission at Paris—a work on which the United States Geological Survey began over a year ago. It mapped in graphic manner the distribution of not only the raw materials—mineral fuels and ores—but also the water powers of the world, both developed and undeveloped. The power question is a world question. France and Italy are interested in making the white coal do the work of the black coal, and for two years now a British commission has been working on this same proposition of consolidation of power systems and centralization of power supply. The speaker added:

"And their reason for economy is outspoken—to meet American competition in the world markets. With more expensive fuel and practically no water power England must get more kilowatts from the ton of coal and so reduce the power item in manufacturing costs. On the other hand, it is New England's clue to keep in the lead by making the power supply free from any danger of shortage such as threatened us in the winter of 1917-1918, by securing cheaper power and thus increasing its use by every industry.

"If the British engineers are planning an annual saving of 50,000,000 tons in the fuel account of England, a tonnage twice New England's consumption of soft coal, our own engineers must meet this competition in industrial efficiency. Since modern machinery multiplies man power, cheap electricity is the only method of harmonizing high wages and low costs. Hitching up America's coal and America's water power most efficiently is absolutely essential if American standards of living are to be maintained. The super-power plan thus becomes a large item in the human welfare plan."

Buy Cheerfully—It Is Your Share

WORK OF THE INTERNATIONAL ELECTROTECHNICAL COMMISSION

Prof. C. A. Adams and H. M. Hobart Are to Attend Meetings in France and England as Representatives of the A. I. E. E.

Prof. Comfort A. Adams, president of the American Institute of Electrical Engineers, and H. M. Hobart of the General Electric Company have sailed for Europe to attend conferences in France and England on engineering standards. A meeting of the special committee on rating of the International Electrotechnical Commission is to be held in Paris, and conferences are also to be held in England.

Advices from England say that the question of reorganization of the entire commission is under consideration. A meeting of the commission will be held at which a number of matters will be taken up. Among these will be that of the question of the enemy countries which were represented on the commission before the war. A delegate will be appointed to represent the British interests as a successor to the late Dr. S. P. Thompson.

It is recognized in England, according to the announcements published there concerning the work of the commission, that Europe has not been able to give much attention during the war to research in connection with the rating of electrical machinery and that consequently there has not been so much progress in knowledge of insulating materials as in the case of America. In addition, misunderstandings have arisen due to the fact that both American and British commissions have, with the best intentions, slightly exceeded in certain cases the limiting temperatures already adopted by the International Electrotechnical Commission. On account of misapprehension which has developed as a result on the part of the French committee, the meeting of the special committee on rating, to be held in Paris, was called. This committee includes representatives from Belgium, France, Great Britain, Italy, Sweden, Switzerland and the United States.

It is announced that the question of graphical symbols in electrotechnics has been under discussion in this country, Great Britain and Italy, and that as a result a large amount of preparatory work will be at the disposal of the special committee on symbols.

An international standard for the resistance of aluminum will probably be adopted in the same manner as has been done for copper. It is suggested by the French committee that the commission should also take up the subject of screw lamp sockets and holders.

Bring the Boys Home—Buy Notes

NEW AMERICAN ENGINEERING STANDARDS ASSOCIATION PLAN

Report of Bureau of Standards Conference on Industrial Safety Codes and Proposed Development of National Organization

The Bureau of Standards has issued a report of a conference on industrial safety codes held at the bureau on Jan. 15, 1919. A proposal for the organization of an American Standards Association is included. The report was prepared by Prof. Comfort A. Adams, chairman of the American Engineering Standards Committee; H. W. Forster, member executive committee of the National Safety Council and the National Fire Protection Association, and Dr. Edward B. Rosa, chief physicist of the Bureau of Standards.

The first plan submitted by Dr. Rosa on behalf of the Bureau of Standards provides that the bureau shall undertake the formulation of industrial safety codes with the coöperation of all interested bodies, coördinating the work now being done along such lines by a number of independent agencies such as the various state commissions, engineering societies and insurance and manufacturing organizations. It is also proposed by the bureau that it should appoint a large conference committee of twenty-five to fifty members, which shall be thoroughly representative of the many interests concerned in safety standards, with which committee the bureau would consult as to general matters of policy and procedure.

The second plan suggested by Dr. Rosa involves the American Engineering Standards Committee and its procedure. From a series of conferences there resulted a general agreement that the Engineering Standards Committee is organized along the right lines and has a very excellent procedure for supervising standardization work but that it would be more effective if it represented a much larger number of societies and if it had a more generous financial support than the five founder societies would be able to give it.

The matter was finally considered at a meeting, on April 12, of the American Engineering Standards Committee, at which representatives of the fire-protection and safety interests, the federal government and certain engineering and commercial associations were present by invitation of the committee. It was unanimously voted by the committee to ask the five founder societies to amend the constitution of the committee so as to permit other engineering or commercial organizations or governmental departments having an interest in engineering or industrial standards to be admitted to membership in it with full rights and privileges, including the responsibility of approving any subsequent changes in the constitution.

The general sentiment was favorable to a large increase in membership of the committee, and it was voted to recommend to the founder societies that the name be changed to the American Engineering Standards Association. It is confidently expected that the changes requested in the committee's constitution will be approved by the five founder societies in the near future. The way will then be open for the committee, or the American Engineering Standards Association, as it will be called, to develop into a broad democratic organization, which will completely remove the ground for such criticisms as were expressed at the Washington conference.

You Bought the Others—Buy Again

INFLUENCE OF THE WAR ON COMPANY OPERATIONS

Continental Gas & Electric Corporation Had to Operate Seven Uneconomical Stations but Plans to Extend Transmission Lines This Year

Reviewing conditions in the annual report to stockholders for 1918, C. S. Eaton, president Continental Gas & Electric Corporation, Cleveland, says that the results to the company of the more important war regulations were:

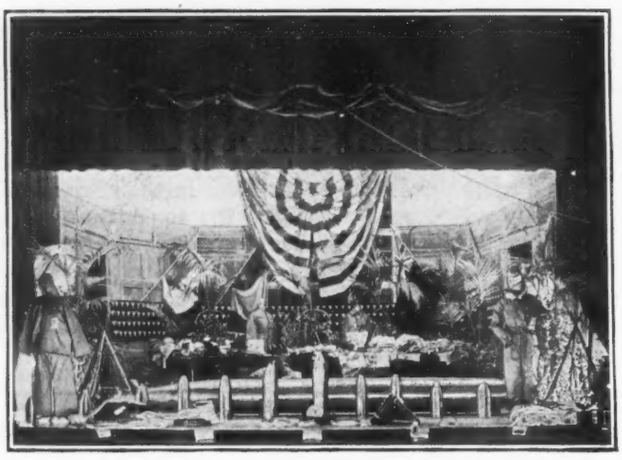
1. Increases in costs of coal, labor and material.
2. Increases in freight rates.
3. Reduction in hours of lighting through the daylight-saving plan.
4. Prohibition of street and display lighting on certain days.
5. Loss of power load through the closing down of non-essential industries.
6. The practice of economy on the part of consumers through the appeals to all to save.
7. The calling to the colors of many of the skilled electricians and engineers.
8. Inability to make extensions and additions to business through the restriction to war uses of copper, iron and construction materials.

In some industries such an enlistment in government service was coupled with sales to the government at high prices and large profits. In the case of many public service corporations, adds Mr. Eaton, it meant the paying of double prices for everything consumed and getting the same or only slightly increased prices for the output sold.

The company was further handicapped in that during the preceding year it had acquired seven small power stations lying in the path of projected transmission lines. It was planned to eliminate these stations and to supply their territory from the larger stations. War conditions made it impossible to secure construction material, and it was necessary during the whole year to operate these seven uneconomical power houses.

With the prospect of settled financial conditions it will be the policy of the directors to resume the expansion of the company's business. During the year 1919 plans will be developed to furnish cheaper power to the entire territory, and additional transmission lines will be constructed so that all small, uneconomical power houses can be closed down.

Brooklyn's Part in the Great War



"Brooklyn and the Brooklyn Edison Company in the War" was the subject of a recent address by T. I. Jones, general sales agent of the company, at a meeting under the auspices of the Brooklyn Edison Section of the N. E. L. A.

LIGHTING CODE DISCUSSION AT MEETING IN BOSTON

Illumination Experts Favor Regulation to Obtain Better Service, but Desire Elasticity in the Application of Plan

G. H. Stickney of the Edison Lamp Works of the General Electric Company addressed a joint meeting of the New England Section of the Illuminating Engineering Society and the Boston Section of the American Institute of Electrical Engineers on April 22 upon lighting codes, following his paper of April 11 at New York (ELECTRICAL WORLD, April 19, page 806). At the close of the paper a discussion took place in which the desirability of a code was generally conceded, provided sufficient latitude be left in its enforcement. Dr. Louis Bell, consulting engineer, Boston, stated that he is now engaged in formulating a code at the request of the Masachusetts Board of Labor and Industries and that he welcomes suggestions from engineers and others with regard to specifications. A rather general code, he thought, giving a good deal of liberty to the inspector as to classification, is the safest. A common-sense interpretation of emergency lighting requirements is essential. The latter are vitally important in a plant where, for example, 150 girls are at work in a wooden building on celluloid products, compared with a small machine shop employing a dozen or so men.

J. W. Cowles, superintendent of the installations department, Boston Edison company, questioned the advisability of leaving too much to the inspector. The codes presented by Mr. Stickney must of necessity receive the hearty support of central stations except as regards duplicate lighting provisions. In theaters, for example, the cost of an extra service for emergencies is well warranted, but in general it is undesirable from the central-station standpoint to require a separate auxiliary source in industrial and mercantile lighting. Such a requirement involves the central station in additional expense, forces complications in metering and in carrying out rate regulations, and leads to expensive wiring. Apart from the increased cost of labor, the effect of the rules and regulations extant is to increase the cost of construction, and further tendencies in this direction should be discouraged. During the discussion the value of the portable illuminator for periodical surveys of lighting conditions in industrial plants was emphasized. Instruments accurate to about 95 per cent and costing but $25 each are now on the market and should become a part of the testing paraphernalia of an efficiently managed plant so that production will not suffer from either neglect or the insensible deterioration of the intensity of illumination.

They Are the Victory Notes

STUDY OF MOVEMENTS OF PRICES AFTER THE WAR

Department of Labor Statement Shows that It Was Thirteen Years After Civil War Before Prices Returned to Pre-War Level

Through its information and education service the Department of Labor has issued a statement giving results of a study of prices during the war and readjustment period by the Division of Public Works and Construction Development. This shows that it was thirteen years after the civil war before prices returned to the pre-war level.

The statement says that at the beginning of the year 1865, the end of the civil war being in sight, wholesale prices broke suddenly and violently. During the first six months of the year prices in general fell off 27 per cent from the high level of January. However, the break in wholesale prices, though unprecedented in violence and accompanied by the unsettling influence of the end of the great war, produced no business crisis or depression. Through the latter half of 1865 prices recovered from the low point until in January, 1866, they stood just 16 per cent below the level of January, 1865. From the beginning of 1866 prices dropped slowly downward. They did not reach the pre-war level until the year 1878. As is well known, during that period of inflated currency gold was at a premium. However, commodity prices remained above the prices of gold up to and including the year 1877.

"Building materials declined in price along with other commodities during the first half of the year 1865," the statement continues. "However, the fall was less than in the case of other commodities. Whereas commodities in general dropped 27 per cent, building materials dropped only 14½ per cent. The recovery during the second half of the year was more marked, prices of building materials returning to the level of the last quarter of the year 1864 and remaining at that level for a period of a year before the decline set in. The index figure for the building materials group remained higher than that for all commodities up to and including the year 1874.

"The currency was on a distinctly unsound basis in the civil war reconstruction period. The sharp fluctuations in prices gave rise to much speculation, and the opportunities for development of the resources of the country, such as unused land, rivers and harbors, building of railroads, etc., led to overexpansion of business resulting in the financial panic of 1873. This panic was not accompanied by any sharp decline in prices. . . .

"The principal cause of the return to the pre-war level was the fact that there was such abundant oppor-

tunity for the development of new and more economic methods of production in the shape of new forms of machinery and new kinds of business organizations. These opportunities we do not have at the present day in any measure comparable with the previous period."

Help by Lending Freely

RATE INCREASES BY NORTH AMERICAN COMPANY PROPERTIES

Despite Inertia of Regulating Authorities, the Subsidiary Companies Obtained Adjustments Which Pave Way for Better Results in 1919

President James D. Mortimer of the North American Company comments on the subject of rate increases by the subsidiary companies in his annual report to stockholders for 1918.

Despite the inertia shown by the regulating authorities in permitting increases in rates to offset increases in operating expenses, the subsidiary companies, Mr. Mortimer said, obtained rate adjustments which permitted the continuation of dividends. Most of these adjustments came so late in the fiscal year just closed that their effect, while important in the general result, was relatively small in adding to the actual net income of the company. They paved the way for better results during the year 1919.

The Victory Is Won—Pay for It

ECONOMY IN HANDLING MATERIALS AT PORTS

Engineering Committee of Material-Handling Machinery Manufacturers to Study Reducing Cost of Handling Cargoes

Port and harbor development throughout the United States and the expected shortage of labor as business is resumed are responsible for many requests for information and suggestions made to the Material-Handling Machinery Manufacturers' Association.

The first meeting of the engineering committee, appointed by President Calvin Tomkins, was held at the association quarters, New York, on April 9. The members of the committee as at present constituted are: W. B. Clarke, Manning, Maxwell & Moore, Inc.; S. H. Libby, Sprague Electric Works; R. W. Scott, Otis Elevator Company; D. V. Jenkins, Watson Elevator Company; L. C. Brown, Elwell-Parker Electric Company; A. F. Case, Wellman-Seaver-Morgan Company; J. C. Walter, Alvey-Ferguson Company, and J. A. Shepard, Shepard Electric Crane & Hoist Company.

The committee will make studies of large industrial plants and a special study, based on the selection of one of the new port terminal projects, of a complete equipment for general cargo handling. The discussion indicated the necessity of taking into consideration the tremendous saving made in quick ship turn-around as an important factor in reduction of the cost of cargo handling, as this cost without the use of modern equipment has increased so much that some of the larger steamers which formerly figured on $7,000 to $15,000 per day loss for every day in port are now compelled to stand 50 to 70 per cent additional.

Arrangements have been made by the committee to meet with the engineers of the New York-New Jersey Port Commission to discuss the various phases of cargo handling and the application of machinery to the problem when plans are made for the complete development of the port of New York and New Jersey; also with the committee appointed by the Sanitary Potters' Association to discuss possible savings in that industry through the use of modern handling equipment. Plans will be made to develop a standard and proper system of cost accounting for the handling of cargo.

Zenas Carter, secretary and manager of the association, asserts that interest in the association by manufacturers and harbor commissions is increasing daily and that the committee on membership is making rapid progress.

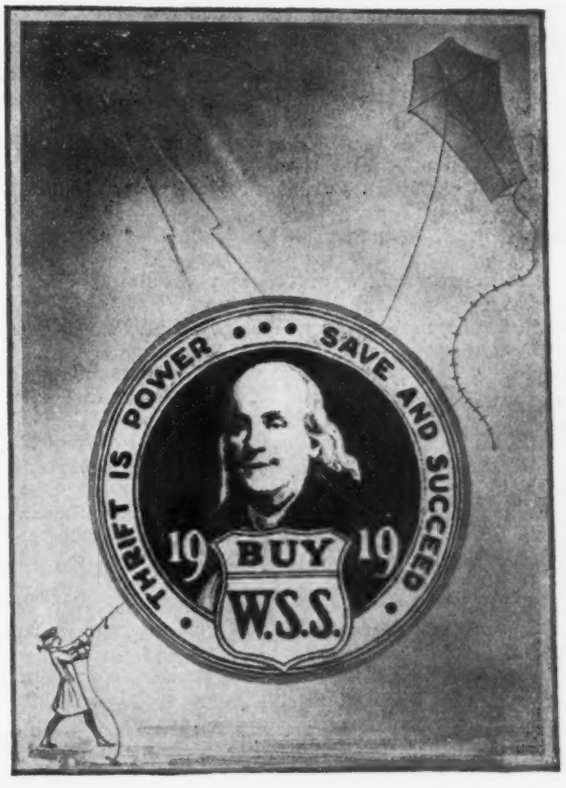
Lend for the Sake of Victory

EXPANSION OF STANDARD GAS & ELECTRIC COMPANY

President H. M. Byllesby Confirms Reports of Negotiations for Established Oil Property-Arrangements Still Under Discussion

Regarding verious reports, President H. M. Byllesby of the Standard Gas & Electric Company says:

"Negotiations have been pending for some time looking to consolidation with the Standard Gas & Electric Company of a large and long-established and prosperous oil property, comprising large acreage, production, complete refining plant, pipe lines, distribution and tank cars. These negotiations are still progressing."



Census Bureau Report of Electric Light and Power Stations—1917

	Minnesota			Louisiana			Idaho		
	1917	1912	Per Cent of Increase* 1912 to 1917	1917	1912	Per Cent of Increase* 1912 to 1917	1917	1912	Per Cent of Increase* 1912 to 1917
Number of establishments	255	195	30.8	85	50	.....	46	38	.....
Commercial	123	91	.....	49	27	.....	38	35	.....
Municipal	132	104	.....	36	23	.....	8	3	.....
Income	†$12,968,715	†$6,937,841	86.9	‡$3,244,789	‡$2,278,754	42.4	$2,368,619	$1,615,940	46.6
Electric service	$12,080,171	$6,647,199	81.7	$3,220,314	$2,251,102	43.1	$2,202,356	$1,580,082	39.4
All other	$888,544	$290,642	205.7	$24,475	$27,652	—11.5	$166,263	$35,858	363.7
Total expenses, including salaries and wages	$11,191,974	$5,580,525	100.6	$2,459,868	$1,604,019	53.4	$1,947,657	$1,537,260	26.7
Number of persons employed	2,520	1,568	60.7	669	489	36.8	469	324	44.8
Salaries and wages	$2,011,145	$1,222,493	64.5	$530,515	$371,034	43.0	$450,753	$334,063	34.9
Total horsepower	225,541	148,111	52.3	36,005	27,165	32.5	56,422	56,375	0.1
Steam engines:									
Number	250	247	1.2	81	86	.....	10	14	.....
Horsepower	119,001	63,184	88.3	29,248	26,175	11.7	2,650	4,525	—41.4
Internal-combustion engines:									
Number	148	54	.....	72	9	.....	4	.....	.....
Horsepower	8,092	4,755	70.2	6,757	990	582.5	148	.....	.....
Waterwheels:									
Number	88	76	.....	.....	.....	.....	71	63	.....
Horsepower	98,448	80,172	22.8	.....	.....	.....	53,624	51,850	3.4
Kilowatt capacity of dynamos	162,854	93,502	74.2	25,762	19,169	34.4	37,103	35,656	4.1
Output of stations, kilowatt-hours	440,932,508	186,045,055	137.0	26,009,144	18,328,080	41.9	145,307,596	115,812,292	25.5
Stationary motors served:									
Number	20,915	12,203	71.4	2,863	2,428	17.9	867	1,723	—49.7
Horsepower	282,784	75,973	272.2	37,189	24,557	51.4	12,668	27,142	—53.3
Number of street lamps:									
Arc	5,565	6,495	—14.3	4,295	4,474	—4.0	924	1,109	—16.7
Incandescent, etc	48,223	21,776	121.4	7,266	4,451	63.2	6,863	3,886	76.6

* A minus sign (—) denotes decrease; percentages are omitted where base is less than 100.
† Exclusive of $1,831 in 1917 and $123,234 in 1912, reported by street and electric railway companies as income from sale of electric energy.
‡ Exclusive of $691,798 in 1917 and $549,047 in 1912, reported by street and electric railway companies as income from sale of electric energy.

ORGANIZE AMERICAN BUREAU OF WELDING

Prof. C. A. Adams Elected Director of the Bureau at the Organization Meeting—Research Committee to Conduct Investigations

At a meeting of the American Bureau of Welding on April 11, at the Engineering Societies Building, New York, bylaws were adopted and the following officers elected: Director, Prof. C. A. Adams; vice-director, H. M. Hobart; vice-director, A. S. Kinsey; treasurer, W. E. Symons; secretary, H. C. Forbes. Regular meetings of the bureau are to be held on the third Friday of each month. The bureau voted to establish a research committee for the purpose of carrying out the plan of coöperation in conducting investigations in welding and appointed the following members:

Adams, C. A., American Welding Society, New York.
Alexander, D. C., Quasi-Arc Weldtrode Company, Brooklyn.
J. I. Banash, 1724 Forty-second Street Building, New York.
Dr. C. K. Burgess, Bureau of Standards, Washington, D. C.
W. J. Beck, American Rolling Mill Company, Middletown, Ohio.
Alex. Churchward, Wilson Welders & Metals Company, New York.
Jack Churchward, Wilson Welders & Metals Company, New York
H. Jasper Cox, Lloyd's Register of Shipping, New York.
G. H. Clevenger, National Research Council, Washington, D. C.
L. H. Davis, Linde Air Products Company, New York.
J. H. Deppeler, Metal & Thermit Corporation, Jersey City, N. J.
J. G. Dudley, Chester Shipbuilding Company, Philadelphia.
F. C. Elder, Newburgh Steel Works, Cleveland, Ohio.
E. H. Ewertz, Bethlehem Shipbuilding Company, Elizabeth, N. J.
F. M. Farmer, Electrical Testing Laboratories, New York.
F. L. Fairbanks, Quincy Market Cold Storage & Warehouse Company, Boston.
H. C. Forbes, American Welding Society, New York.
C. J. Holslag, Electric Arc Cutting & Welding Company, Newark, N. J.
J. H. Horn, John A. Roebling's Sons Company, New York.
H. M. Hobart, General Electric Company, Schenectady.
Prof. R. G. Hudson, Massachusetts Institute of Technology, Cambridge, Mass.
W. J. Jones, Chester Shipbuilding Company, Chester, Pa.
R. P. Jackson, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.
Zay Jeffries, Aluminum Castings Company, Cleveland.
H. W. Jacobs, Oxweld Railroad Service Company, New York.
Prof. A. S. Kinsey, Stevens Institute of Technology, Hoboken, N. J.
Com. H. G. Knox, United States Navy Yard, Norfolk, Va.
Hermann Lemp, General Electric Company, Erie, Pa.
J. C. Lincoln, Lincoln Electric Company, Cleveland, Ohio.
W. L. Merrill, General Electric Company, Schenectady.
John Martin, American Bureau of Shipping, New York.
Prof. H. F. Moore, University of Illinois, Urbana, Ill.
S. W. Miller, Rochester Welding Works, Rochester, N. Y.
Victor Mauck, John Wood Manufacturing Company, Conshohocken, Pa.
C. A. McCune, Page Steel & Wire Company, New York.
J. W. Owens, Norfolk Navy Yard, Norfolk, Va.
Stuart Plumley, Davis-Bournonville Company, Jersey City, N. J.
E. J. Rigby, Quasi-Arc Weldtrode Company, Brooklyn.
Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.
W. Remington, Thomas Welding Company, West Lynn, Mass.
M. H. Roberts, Air Reduction Company, New York.
W. E. Ruder, General Electric Company, Schenectady.
Prof. A. W. Slocum, University of Vermont, Burlington, Vt.
Bradley Stoughton, American Institute of Mining Engineers, New York.
F. N. Speller, National Tube Company, Pittsburgh, Pa.
H. S. Smith, Prest-O-Lite Company, New York.
William Spraragen, 33 West Thirty-ninth Street, New York.
H. S. Starling, Bureau Veritas, New York.
R. E. Wagner, General Electric Company, Pittsfield, Mass.
H. I. Walsh, Newport News Shipbuilding Company, Newport News, Va.
Prof. H. L. Whittemore, Bureau of Standards, Washington, D. C.
Charles Wirt, Wirt Company, Germantown, Pa.

From time to time the membership of the committee will be increased. At the meeting of directors of the American Welding Society on April 11 J. H. Deppeler, Metal & Thermit Corporation, Jersey City, N. J., was elected a director.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

E. S. J. A. Convention.—The Electrical Supply Jobbers' Association will hold its regular meeting at Hot Springs, Va., June 10 to 12.

A. I. E. E., Toronto Section, and Engineering Institute of Canada, Hamilton Branch.—G. E. Stoltz discussed "Steel Mill Electrification" at the joint meeting of these two bodies held on April 11.

Illinois Association of Electrical Contractors and Dealers.—About the middle of June the midsummer meeting of the Illinois Association of Electrical Contractors and Dealers is to take place in Decatur.

N. E. L. A., Duquesne Light Company Section.—James L. Geary has been elected president of this section of the National Electric Light Association, and Lynn M. Wilson has been chosen secretary.

National Association of Electrical Contractors and Dealers.—The annual meeting of the National Association of Electrical Contractors and Dealers will be held in Milwaukee, Wis., on July 16, 17 and 18.

San Francisco Electrical Development League.—F. E. Anderson, electrical engineer and inspector for the United States Shipping Board, spoke on "Ship Wiring and Wiring Inspection" at the April 14 meeting of the league.

A. A. E., Washington Chapter.—At its March 25 meeting the Washington Chapter, American Association of Engineers, elected Harry Stevens, civil engineer, as president and E. L. Howard, Bureau of Yards and Docks, Navy Department, as secretary.

A. I. and S. E. E.—The monthly meeting of the Association of Iron and Steel Electrical Engineers is to take place to-night in Pittsburgh, Pa. Lieut. A. M. McCutcheon, U. S. N., will have for his subject "Electricity Afloat; Steel-Mill Practice Applied in the Navy."

Jovian Electric League, Los Angeles.—At the April 9 meeting W. G. Eisenmayer, manager of the Los Angeles Ice & Cold Storage Company, gave a talk on "Ice and Electricity." Harry A. Williams, war correspondent for the Los Angeles *Times*, told of his experiences in France.

N. E. L. A., Philadelphia Electric Company Section.—Charles J. Russell, general commercial manager of the Philadelphia Electric Company, spoke on "The Progress of Business During 1918" before the commercial branch meeting of this section of the National Electric Light Association held on April 22.

A. I. E. E., Denver Section, and A. S. C. E., Colorado Association of Members.—At a joint meeting of these two divisions of the American Institute of Electrical Engineers and the American Society of Civil Engineers held on April 9 Lieut.-Col. H. S. Crocker spoke on "The Construction of the Army Supply Base at Brooklyn."

A. I. and S. E. E., Chicago Section.—A joint paper entitled "Safety in Steel Mills" is to be presented at the April 26 meeting of this section of the Association of Iron and Steel Electrical Engineers by C. M. Brading, superintendent of safety, and F. A. Wiley, electrical superintendent, Wisconsin Steel Company, South Chicago, Ill.

Stickney Speaks on Lighting Codes in Chicago.—George Stickney reviewed the industrial lighting codes in effect in the United States at a meeting of the Illuminating Engineering Society, Chicago Section, and the Chicago Section, American Institute of Electrical Engineers, held in Chicago on April 17. J. A. Hoeveler, electrical engineer for the Industrial Commission of Wisconsin, discussed the situation surrounding the Wisconsin code.

A. I. and S. E. E. and A. I. E. E., Chicago Sections.—On May 26 the Chicago Sections of the American Institute of Electrical Engineers and the Association of Iron and Steel Electrical Engineers will hold a joint meeting, at which two lectures are to be given. One will be by J. C. Wilson, assistant chief engineer Cutler-Hammer Manufacturing Company, Milwaukee, Wis., entitled "Measuring Gas Electrically," and the other will be by B. E. Fernow of the same company, on "Lifting-Magnet Operation." Both these lectures are to be illustrated.

American Institute of Electrical Engineers

Spokane Section.—"City Transportation from an Engineer's Viewpoint" was the title of a talk given before the April 18 meeting of this section by T. E. Phipps, former chief engineer of the Washington Public Service Commission.

Madison Section.—"Recent Developments in Electric Lighting" and "The Industrial Lighting Code of Wisconsin" were presented by W. M. Skiff, National Electric Lamp Works, and John A. Hoeveler, Industrial Commission, before this section on April 10.

Lynn Section.—On April 12 this section held its eighth annual banquet, with more than 250 in attendance. Richard H. Rice acted as toastmaster and in the course of his remarks said that the Lynn Section is now the largest one in the Institute, having 1651 local members and 21 national members. Ira Cushing, chairman of the Boston Section, and Marshall P. Thompson were the speakers of the evening.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Reasonable Discrimination.—In a decision relating to the Belgrade Power Company the Maine Public Utilities Commission takes up several matters arising from the fact that the largest consumer is the principal business of the community. It says in part: "The current is taken from the generating station by two wires. One serves the property of the Belgrade Hotel Company, the other serves the public generally. The respondent offers only a lighting service, and cuts off the current in the morning. But current is transmitted over the wire running to the hotel property in the daytime when there is occasion to use it. Customers served over the other wire do not get this service, although some of them would like it. The evidence does not show many of these, but the principle is the same. It appeared that on some dark days the current was turned on to both wires. Respondent claimed that this was done whenever it was requested. However this may be, it is apparent that there is discrimination. It does not necessarily follow that the practice is unlawful. Only unreasonable discriminations are prohibited. It is unlawful if part of the public is arbitrarily and without just cause denied equal benefits from the utility. This is the matter complained of in this respect, and it requires careful consideration. The evidence shows that the plant is not capable of giving unlimited service to all of its customers; it does not satisfy us that the demand for service generally is sufficient to justify an order requiring substantial additions to the plant. Under such circumstances it is allowable for a utility to serve some and deny others, when this is done in such a manner as best to subserve the public interests generally and does not give one an unfair advantage over others in any of the ways indicated above. A utility cannot be required to take on new customers or to extend its service where it can be done only to the disadvantage of the public generally or results in unreasonably diminishing the aggregate benefits to be enjoyed by the community. There is not sufficient power to serve both the lighting customers at night and the hotel and other customers during the day. There is sufficient to give the service now being rendered. There is no evidence that the use of the current at the hotel in the daytime impairs the night service. The hotel is the principal business of the community. It is improbable that an electrical plant could be maintained at all without it."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Every House Wired in Pasadena, Cal.—Pasadena, Cal., in responding to the call of the Society for Electrical Development for participation in the "Electrify your home" campaign, claims that every house in the city is wired for electricity. The message says: "Sorry we have no need for your campaign literature inasmuch as every house in Pasadena is wired and connected. Population, 42,000; electric meters connected, 15,600. Can you beat it?"

Cost of Arc Lighting.—The twenty-third annual report of the city of Detroit, Mich., covering the period from July 1, 1917, to June 30, 1918, shows that the cost of operating arc lamps in the station has increased steadily over the last three years covered by the report. The costs per lamp follow: Year ended June 30, 1916, $24.16; year ended June 30, 1917, $27.24; year ended June 30, 1918, $32.71. Since a new accounting system has been installed it has been possible also for the city to allocate the cost of producing power for arc lighting and for incandescent lighting and power in public buildings. The cost for arc lighting is 3.72 cents per kilowatt-hour, and the cost for incandescent lighting and for motor service is 3.3 cents per kilowatt-hour.

Armored Cables of Unusual Length.—The Habirshaw Electric Cable Company, Inc., is making two cables which are somewhat unique in the history of the cable industry in this country. One cable is for the United States Coast Guard and consists of two conductors, each of seven-strand No. 18 B. & S. insulated to 10/32 in., 30 per cent Para, and taped. The two conductors are twisted together with paraffined jute fillers, taped, with serving of jute, armored with No. 6 B. W. G. galvanized-iron armor and then served with jute and asphalt. The cable is a little over 1¾ in. in diameter and weighs 2610.8 lb. per 1000 ft. The particular feature of this cable is that it must be delivered in one continuous length of 30 miles, which means a weight of more than 413,000 lb. The other cable is being made for the government of the Philippine Islands. It consists of a single conductor, made of seven-strand No. 20 B. & S., insulated to $\frac{8}{32}$ in. with 40 per cent compound, taped, a serving of jute, armored with 0.092 in. galvanized-iron armor, over which is a serving of jute and asphalt. The diameter of this cable is approximately 1 in. and its weight 796 lb. per 1000 ft. The total quantity is 200 miles, to be delivered in four lengths of 50 miles each, so that each length will weigh over 210,000 lb.

Revenue from Appliance Sales Not to Be Taxed. — The legislative committee on finance in Connecticut has prepared an amendment which will exempt electric, gas, water and power companies from including the proceeds from the sale or rental of appliances in the assessment of 1½ per cent of gross earnings which has been in effect for some time.

Massachusetts Companies Reduce Rates.—The Quincy (Mass.) Electric Light Company has reduced its rate from 13½ cents per kilowatt-hour to 12 cents. The company renews tungsten lamps of all usual sizes free and has been doing so for several years. The Worcester Electric Light Company has reduced its lighting rate from 8 to 7½ cents per kilowatt-hour and on May 1 will abandon the 4-mill surcharge on small power business which it put in effect late last year. The coal clause in the Worcester power rates will, however, be retained by the company.

Repairing the Kaiser's Ravages.—The Society for Electrical Development, New York, has issued a booklet in regard to its work and the benefits of membership in electrical coöperation.. Pointing out the need of cooperation, the Society for Electrical Development goes on to say: "To meet this post-war crisis, to meet these increased costs and pay our share of the world debt caused by the Kaiser's madness, the electrical industry has got to do more business and do it quick. It must expand—speed up. Dormant markets must be vitalized; active markets must be forced. Where there is no business it must be created; where it exists it must be stimulated."

Shortage of Electrical Energy in Japan.—The *Electrician's Friend* of Tokyo, Japan, notes that "the phenomenal scarcity of electric power in recent times has resulted in the appearance of premium on the use of electric power and even on electric light. A premium as high as 300 to 400 yen on the use of a 1-hp. motor is bidden in a certain city where weaving industry flourishes. In other cases over 100 yen on a 1-hp. motor is claimed by the seller of the power right. In another case a premium of over 1 yen is claimed on the transfer of each incandescent lamp. The extraordinary phenomenon is due to the sudden growth of general industry on one hand and inability on the part of power companies to enlarge their plants owing to the unprecedented high price of machines and other equipments on the other hand. In Tokyo the scarcity of electric power during the winter season has been so acute that the power companies had made an agreement not to sell further energy to the customer, new or old, until the season of drought is over."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Workmen's Compensation Grievances.—One not an employee in an excepted class in the Texas workmen's compensation act may not assert any grievance that excepted class might have regarding the validity of the act, according to the Supreme Court of the United States in Middleton versus Texas Power & Light Company (39 S. C. R. 227).

Tax for Electric Lights.—A city, under Code, Section 894, Subdivision 6, cannot tax agricultural land within the city limits for electric light purposes, in view of Section 616, providing that land within the city limits not divided into parcels of 10 acres or less, occupied in good faith for agricultural purposes, shall not be taxable by a city except for road taxes, the Supreme Court of Iowa holds in a recent decision (171 N. W.).

Reasonable Rate Order Affirmed.—On an appeal from an order of the Corporation Commission of Oklahoma fixing the rates to be charged for electric light and other electric service, the presumption obtains, by reason of Section 22, Article 9 of the constitution, that the order is reasonable, just and correct. Where there is evidence in the record reasonably tending to support the findings of fact as to the value of the property used by the electric company as a basis for determining what is a reasonable return on the investment, the Supreme Court of Oklahoma has held that the order will not be disturbed (179 P. 26).

Powers of Public Service Commissions.—The fundamental theory of the Public Service Commissions law is that there shall be one rate for the same service, the Appellate Division of the Supreme Court of New York holds (174 N. Y. S. 868). The Public Service Commission is a body of limited powers and has no judicial functions to discharge, having power to regulate services rendered and prices to be charged, but no power to enforce its acts or restrain violations of law. The Public Service Commission cannot exercise equity jurisdiction and attempt to compel a public service corporation to perform its contracts with its patrons according to their terms. An unexpired contract does not authorize a public service company to charge a less rate for service rendered than that prescribed by effective schedules, even though schedules of such rates are filed by the public service company, the Appellate Division holds.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

J. M. Smith has resigned the position of managing engineer of the Triumph Electrical Company of Cincinnati to become associated with the Texas Company, New York City.

Thomas A. Reed has been promoted from coal traffic manager of the Central Power Company of Canton, Ohio, to new-business manager, succeeding Robert E. Lane, who has resigned to enter another class of business.

George A. Murch, who for the past three years has been manager of the Public Electric Light Company, St. Albans, Vt., and superintendent of the St. Albans & Swanton Traction Company, has resigned, effective the early part of the summer.

Prof. Comfort A. Adams, dean of the faculty of the Harvard School of Engineering at Cambridge, Mass., and H. M. Hobart of the General Electric Company have sailed for France to attend a meeting of a special committee on rating of the International Electrotechnical Commission at Paris, May 5 to 7. Professor Adams and Mr. Hobart will represent the American Institute of Electrical Engineers and the American Engineering Standards Committee. They will also attend a meeting of the British Engineering Standards Committee, to be held in London, and return to the United States about the middle of June.

E. L. Andrews has recently been appointed general agent of the Underwriters' Laboratories, a position which has been vacant since the death of James E. Latta on Jan. 17, 1918. The work of the general agent covers matters of publicity and development and the investigation of special questions arising therefrom. Mr. Andrews, after graduation from the Massachusetts Institute of Technology, was engaged in electrical engineering first with the Western Electric Company and then with the American Telephone & Telegraph Company. He was later a member of the engineering staff of Westinghouse, Church, Kerr & Company. During the war he has been associated with the Air Nitrates Corporation of New York on the design and construction of three large plants to produce ammonium nitrate for the Ordnance Department.

D. H. Braymer, formerly editor of the *Electrical Record*, has been appointed managing editor of the ELECTRICAL WORLD. Mr. Braymer, prior to becoming editor of the *Electrical Record* in 1917, was for two years engineering editor of the ELECTRICAL WORLD. Before that he was editor of *Electrical Engineering* of Atlanta, Ga., and of its predecessor, the *Southern Electrician*. Mr. Braymer was born in 1884 in Hebron, N. Y., and was graduated from Cornell University in 1906, with the degrees of A.B. and E.E. Upon graduation he engaged in special work on alternating-current apparatus for the Electrical Testing Laboratories, New York City, resigning to become factory inspector for the Western Electric Company at New York. Later he was appointed special engineer for that company. In 1910 he resigned to engage in editorial work in the electrical field, becoming editor of the *Southern Electrician*.

Obituary

George E. Claflin, a vice-president of the Electric Bond & Share Company, died suddenly April 18, at Atlantic City, where he had gone for the Easter holidays, his death coming as a great

G. E. CLAFLIN

shock to his family and associates. Mr. Claflin was a pioneer in the electric light and power industry. He was born in Providence, R. I., April 4, 1866, and after being graduated from the Massachusetts Institute of Technology in 1888, entered the service of the Westinghouse interests and was connected with some of the earliest electric generating stations in the country. He then helped to organize the Franklin Electric Company of Kansas City, Mo., which built and equipped electric light plants throughout the Middle West. Later he was a member of the firm of Lewis & Claflin, consulting engineers of Providence, R. I. In 1904 Mr. Claflin became associated with the United Electric Securities Company of Boston, and in 1913 he was elected a vice-president of the Electric Bond & Share Company. In this latter position he was in general charge of the operation of all the electric light and power and gas properties under the management of this company. He was a director and a vice-president, among other companies, of the American Power & Light Company, the Idaho Power Company, the Lehigh Power Securities Corporation and the Utah Securities Corporation.

Theodore Stoll, the founder and member of the firm of Russell & Stoll, New York, N. Y., manufacturers of electrical marine fittings and appliances, died at his home in Westfield, N. J., April 18. Mr. Stoll was sixty-one years of age.

Patrick Whitty, the oldest employee in years of service of the Gregory Electric Company, Chicago, died suddenly of heart failure, on April 11. Mr. Whitty started with the Charles E. Gregory Company when that company began business in 1875 and remained with that concern and its successor, the Gregory Electric Company, continuously until his death.

Charles Brinkerhoff Richards, for twenty-five years Higgins professor of mechanical engineering at Sheffield Scientific School of Yale University and professor emeritus for the past nine years, died at New Haven, Conn., on April 20, in his eighty-sixth year. Professor Richards was the inventor of the Richards steam indicator, which contains the essential features of modern indicators. He was one of the founders of the American Society of Mechanical Engineers and was the editor of engineering and technical words and terms in Webster's International Dictionary.

Paul Lüpke, one of the pioneers in the electrical industry, died on Feb. 9. Mr. Lüpke was born in Osnabrück, Germany, in 1861, and was educated at the local Real-Gymnasium and at the Royal Polytechnic Institute, Stuttgart, Württemberg. Prior to coming to the United States in 1884 he had been connected with the Siemens & Halske Works in Charlottenburg and the Allgemeine Elektrizitäts-Gesellschaft in Berlin. Soon after his arrival in this country he installed the first Brush arc-lighting apparatus in Trenton, N. J., and later entered the service of the local company, with which he continued in one capacity and another throughout many changes and consolidations. At the time of his death Mr. Lüpke was in charge of the extensive library of the three companies which make up the Public Service Corporation of New Jersey, besides being editor of *Service*, the official publication of the corporation. For many years he was superintendent of the southern division of the Public Service Company at Trenton, N. J. Mr. Lüpke was an active member of both the N. E. L. A. and the A. I. E. E., being editor of the N. E. L. A. "Question Box" in 1906 and 1907, and also being an occasional contributor to the technical magazines. He will be best remembered by the members of the N. E. L. A. for his short but eminently practical papers of a philosophical flavor, presented at the annual conventions held from 1907 to 1904.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

SECOND-HAND MARKET IN NEW ENGLAND IMPROVED

Boston Lacking in Used Direct-Current Motors— Shortage in General of Good Equipment Prevents Activity in Market

Business is improving in the second-hand electrical machinery market in New England. A record-making volume was handled in 1918, but after the armistice was signed the demand for both new and second-hand equipment declined greatly, and at the opening of 1919 the market was decidedly dull. Within the last few weeks a better tone has been manifested, with considerable recovery of business. The present volume of business in the second-hand field in this district may be estimated at about 75 per cent of that enjoyed in 1918, or approximately 15 per cent in excess of the 1917 rate.

Stocks are somewhat spotty. Dealers in second-hand equipment also generally handle new machinery, and the supply of new equipment on hand is fairly large. Dealers are buying direct-current motors of low voltage and small sizes wherever these are offered, and the demand for small alternating-current motors is also good. In the Boston district in particular there is a decided scarcity in used direct-current motors of moderate size, standard voltages and first-class quality. Odds and ends may be picked up readily enough, but there has not been any general release of motors or other industrial electrical equipment by war-service plants on a scale to affect the market materially so far. On the whole, second-hand stocks of good quality are running rather low.

Prices of second-hand equipment are far above the levels of pre-war business, but late quotations show a reduction of 10 to 20 per cent below those of last fall. During the height of the war many buyers paid prices in excess of quotations on new equipment in order to secure immediate delivery, these prices often being quoted by second-hand dealers outside New England on equipment rushed into this territory. Deliveries of new apparatus have improved so much now that the normal differential between old and new equipment may be expected to hold from henceforth. Prices of used equipment have been forced down somewhat by the manufacture and better deliveries of new apparatus and the tendency to shade prices in the latter to secure the benefits of cash payments and a quick turnover.

The feeling in the second-hand trade is strong that current prices are not likely to fall much for some months. Owners of equipment purchased for war-plant service are holding it rather closely for future use in peace-time commodity production. High labor costs are perhaps the chief factor in maintaining the price of new apparatus, and there is little prospect of a surplus of second-hand equipment of good quality being placed on the market for some time in quantities capable of lowering present price levels. The cost of doing business in the second-hand field seems likely to increase this year perhaps 10 to 15 per cent over 1918. The pressure for lower prices and competition for the available business resulting from the limited supply of high-quality second-hand apparatus now available bid fair to develop a second-hand apparatus market of great activity, and the opinion is expressed in well-informed circles that the volume of business recorded in 1919 will equal or exceed that of last year.

The business now being handled includes varied apparatus which is being thrown upon the market by the modernization and betterment of central stations and industrial plants and rewiring and improvement of mercantile establishments using motors. Many motor drives hastily installed lack efficiency, and these are now being gone over and extensive studies and changes are being effected to enable future production to be more efficiently handled. The rapid expansion of central stations during the war released considerable auxiliary equipment for second-hand service, and this development has not yet ceased in New England. Isolated-plant equipment is in some demand, and interest is growing in the development of small water powers.

FEBRUARY'S ELECTRICAL EXPORTS EXCEED $7,000,000

Batteries, Generators, Insulated Wire and Cable and Motors Show Large Totals in the Month's Foreign Trade

During February, the shortest month of the year, exports of electrical apparatus rose above the seven-million-dollar mark to $7,566,089, distancing January, the previous record holder, by more than $800,000.

Telegraph apparatus exports rose from $56,541 in January to $129,596—an increase of 129 per cent. Telephone apparatus increased 55 per cent over January. This is the highest month for telegraph apparatus, while telephones were exceeded only last March.

Last October $1,147,159 in motors were exported, the highest that has been noted, while in February the value of motors exported was $1,107,268. Transformers increased over January 13 per cent and switches 7 per cent. The assorted apparatus rose 12 per cent over January and 130 per cent over last February. Total exports for the month of February exceeded totals for last February by 120 per cent. Generator exports were surpassed only last May, while February battery exports hold the record of $420,437.

For the eight months ended February last the exports of electrical goods amounted to $46,395,454. This gives much assurance that the $70,000,000 for the fiscal year ended next June will be surpassed, with the remaining four months showing as well as did the month of February.

The accompanying figures were compiled by the Bureau of Foreign and Domestic Commerce:

Articles	February 1918	February 1919	Eight Mos. Ended February 1918	Eight Mos. Ended February 1919
Batteries	$140,742	$420,437	$2,213,082	$2,369,667
Carbons	148,776	161,117	982,036	1,165,977
Dynamos or generators	247,028	387,445	1,533,969	2,346,990
Fans	22,045	121,003	362,776	598,708
Heating and cooking apparatus	49,614	71,136	365,799	578,535
Insulated wire and cable	270,334	710,830	4,038,350	4,608,559
Interior wiring supplies, including fixtures	109,894	211,402	987,280	1,074,949
Arc lamps	387	2,702	7,702	10,383
Carbon-filament lamps	9,626	16,658	14,112	89,729
Metal-filament lamps	228,866	403,379	1,882,873	2,621,817
Magnetos, spark plugs, etc.	152,222	256,280	2,290,168	1,875,682
Meters and measuring instruments	159,753	255,495	939,533	1,531,217
Motors	386,168	1,107,268	4,157,481	6,630,154
Rheostats and controllers	8,520	16,442	115,139	235,188
Switches and accessories	210,643	189,669	1,506,842	1,358,108
Telegraph apparatus, including wireless	24,601	129,596	198,703	435,540
Telephones	125,855	333,180	1,499,085	1,791,144
Transformers	125,240	401,594	1,304,468	2,900,554
All others	1,026,577	2,370,456	10,274,300	14,172,553
Total	$3,446,891	$7,566,089	$34,773,698	$46,395,454

INDUSTRIAL HEATING DEVICES ARE NOW ON SHORT DISCOUNT

Change in Schedule Brings Maximum Discount of 10 per Cent on Soldering Irons, Glue Pots, Large Immersion Heaters and Other Appliances

Soldering irons, rectangular heating plates, immersion heaters over 660 watts, glue pots and hotel toasters have been put on short discounts under the Marsh patent schedule, effective April 13. Formerly all of these items were listed under Part 1 of the schedule and consequently enjoyed the maximum distribution discounts. Jobbers, for instance, were entitled to a maximum discount of 42 and 3 per cent on articles listed under Part 1 (unless billings were over $15,000 for twelve months) and contractors to 30 and 7½ per cent. Now these industrial devices come under Part 3, which provides a short discount of 10 per cent.

The reason given for this change in discounts was that the bulk of these devices are billed by the manufacturer direct to the industrial user and that consequently there was not the necessity for large discounts for trade distribution. The new prices, it was pointed out, make the net price to the user lower than it was previously.

METAL MARKET SITUATION

Copper Slightly Lower, but Buyers are Lacking—Export to Central Powers Anticipated

After a brief season of slight activity, the copper market is again moving along at a dull rate. Copper is quoted at 15.25, which is ⅛ cent below last week, but sales are almost at a standstill. Sales to date for April have been around 20,000,000 lb., and at this rate the month will close with a total movement about one-third that of March. Only enough copper is being bought to carry manufacturers along from week to week.

Exports for February amounted to about 18,000 tons, whereas January showed about 13,500 tons. England, France and Italy have rather large copper stocks, but the Central Powers have little. Purchasing by the latter is expected to open up after peace terms have been settled and methods of payment determined.

Spelter has eased off slightly to 6.40 cents, but demand from consumers shows no improvement.

The spot tin situation in New York is quiet. Difficulty in obtaining the metal in New York quickly is due to the reported stocks of government tin held in the Pittsburgh district only.

The used-metal market continues dull, with aluminum and tin the only moving members.

NEW YORK METAL MARKET PRICES

	April 15	April 22
Copper:	£ s d	£ s d
London, standard spot	76 10 0	76 10 0
	Cents per Pound	Cents per Pound
Prime Lake	15.50	15.50
Electrolytic	15.37½	15.25
Casting	15.00	15.00
Wire base	17.25 to 18.00	17.25 to 18.00
Lead, trust price	5.00	5.00
Antimony	6.75	6.75
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Spelter, spot	6.50	6.40
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent.	30.00	31.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	13.50 to 13.75	13.50 to 13.75
Brass, heavy	7.50 to 8.00	7.50 to 8.00
Brass, light	6.50 to 7.00	6.50 to 7.00
Lead, heavy	4.00 to 4.25	4.00 to 4.25
Zinc, old scrap	4.25 to 4.75	4.25 to 4.75

THE WEEK
IN TRADE

CONDITIONS in the market for wiring supplies and socket devices are improving rapidly. Sales of the latter are running large. Prices are holding pretty firm, although there continues to be an unmistakable tendency toward a lower market. Wire for the first time in many weeks shows no change.

Deliveries are excellent, showing generally that manufacturers have produced stocks again which at least are ample to meet all current requirements. Labor conditions are getting better. Less lack of employment is reported and some places are now calling for labor.

Building is marking time until something more definite shall come out of the iron and steel situation. This matter, however, is expected to be cleared up shortly, after which more building can be expected.

NEW YORK

There is a fine spirit of optimism found among manufacturers. Even the present market is so much more satisfactory than many predicted at the first of the year that their hopes for the near future are indeed bright.

Large orders have been few in the last months, but the number of orders has been high. They have been sufficiently spread among manufacturers to keep a certain steady volume of business going, and a rather sweeping survey is necessary to comprehend that there actually is a fair amount of business.

Manufacturers are not looking for any great jump in sales. The slow, steady increase of the past month or two is expected to continue—this slow, steady increase giving a very pronounced stability to the market. Impetus is expected to be given the market when the Victory Liberty Loan is a thing of the past and the peace terms are accepted. The former is a financial proposition. The latter is a psychological proposition and as such is a vital factor in the market. The stability of the market is found to rest to a great degree on world affairs, and manufacturers, with others, assert their belief that business confidence will return with the signing of peace terms.

Manufacturers report satisfactory collections. The month of March has been good, with some collections under forty days. It is not uncommon to find collections from jobbers around forty-five days, showing the increasing sense of responsibility in the payment of obligations.

The use of bankers' acceptances in export collections is gaining favor, and one prominent manufacturer looks to it as an extremely satisfactory method to be employed in dealing with foreign customers.

SINGLE-PHASE MOTORS.—Several manufacturers have reduced the price of single-phase motors 10 per cent. In some cases the entire range of sizes is down, in one case only the small sizes. The demand is holding high, and factory stocks are holding in fair amounts. Considerable outlet is reported for refrigeration both for household use and for small commercial purposes. Bakers' machinery is utilizing many of these motors.

HEATERS.—The demand for radiant heaters is negligible. Regular dealers are not cutting prices, but some department stores are. Most houses carrying heaters have large stocks with little hope of disposing of them this season.

RANGES.—Several central stations in the East have recently incorporated heating rates favorable to electric range use. One prominent manufacturer reports March sales better than the whole of 1918. The highest-class apartments and large estates are purchasing electric ranges.

CABLE.—The market for transmission and power cable is showing a gradual improvement. Orders are still rather small and well spread out among the manufacturers. The West shows considerable activity.

FLEXIBLE METALLIC CONDUIT.—The demand is running high, and manufacturing is in cases up to normal capacity. Some overtime is noted. Manufacturers hope to be able to get ahead on stocks to take care of the increased buying movement they expect in a few months.

RUBBER-COVERED WIRE.—There has been no change in base reported this week. The demand is not heavy, but there is a steady flow for repair and recircuiting work now going on.

WIRELESS SETS.—Costs are up 10 to 15 per cent over what they were before the ban was placed on them by the Navy Department. The market has opened up well this past week.

BOSTON

The telephone strike in New England, which began April 15 and lasted until the afternoon of the 21st, proved a great inconvenience to industry and upset the electrical trade considerably. Practically all New England except Connecticut was without telephone service for the period, barring extreme emergency calls. The larger jobbers report a comparatively small loss of business after the first two days of the strike. Customers resorted to mail and telegraph communication, and representatives of three prominent houses informed the ELECTRICAL WORLD that their total volume of business for the week was not seriously affected. The smaller houses came through pretty well also, but orders for small quantities of material normally telephoned in from suburban contractors and dealers were in many cases cut out entirely. Retailers and contractors were seriously embarrassed in connection with the shipment and delivery of material owing to the absence of the usual telephone communication with express firms, forwarders, etc. High-salaried men in many branches of the trade were forced by the strike to spend much time on petty errands, and this slowed down business to an annoying extent. During the early part of the strike an enormous amount of work was accomplished within the offices of many electrical establishments in the way of "clean-up" jobs. There is a feeling in the trade that the success of the strike from the employees' standpoint will make for considerable uncertainty in future between employing contractors and their men, although it is believed that a willingness to deal frankly with labor will help to maintain good relations.

Despite the strike a very fair week's business was handled by the jobbers. Collections are rather poor at present and credits are being sharply watched. The increasing activity of contractors is helping the situation somewhat. In some cases the large mills are paying more slowly. New construction is still at a low ebb, but it is announced that the Bethlehem Steel Company has approved the building of a five-million-dollar dry dock at its Fore River plant. Prices show little change. Stocks are well maintained. A shortage is reported in two makes of vacuum cleaners, and metallic flexible conduit is rather scarce. House-wiring campaigns are being pushed successfully in some of the larger cities of New England. Deliveries are excellent, with the exception of a few lines.

SCHEDULE MATERIAL.—Prices are firm, with fair local stocks. Since the middle of March the volume of business has been increasing, and in some cases it is practically as satisfactory as at the time of the armistice. Most of the buying, however, is of the so-called "pick-up" order.

WASHERS AND CLEANERS.—Business is exceedingly brisk. The telephone strike greatly hampered the demonstration of washing machines on account of time lost in making appointments by mail. Machines are being brought into New England by the carload and are being absorbed most satisfactorily.

INDUSTRIAL ELECTRIC TRUCKS.—Sales during March fell considerably below normal. Inquiries are constantly being received, however, and as soon as industry reaches more stable conditions a vigorous expansion in buying is anticipated. The failure of Congress to appropriate funds for army and naval purposes at the late session has temporarily quashed many desirable orders.

STORAGE BATTERIES.—The demand holds up well, the diversity of applications now available serving to steady the business.

ELECTRIC ROAD TRUCKS.—A revival of road-truck development at Boston was predicted at a conference last week in that city attended by manufacturers' representatives and central-station men. Two commercial garages are to be built this spring or summer at Boston, and sales efforts will be concentrated on making sure that the proper economic applications of road trucks are made.

FANS.—Stocks are well prepared to meet early demands. Little retail trade as yet appears, and orders handled favor smaller-sized outfits.

CHICAGO

The interest of the Middle West in foreign trade has been stimulated considerably during the last few weeks by newspaper reports concerning the activities of the Mississippi Valley Association's trade mission to Mexico. This mission is just now returning from that country. The committee on transportation reports that arrangements have been made to facilitate the handling of parcel-post and express packages over the border.

COPPER WIRE.—Both weatherproof and rubber-covered copper wire are holding steady at a 20-cent base.

CONDUIT.—Since the 4-point drop in conduit a few weeks ago no further changes have occurred.

STORAGE BATTERIES.—With the opening of the automobile season the demand for storage batteries is keeping jobbers' stocks pretty well depleted.

FANS.—Jobbers are busy lining up contracts among their dealers for the summer's stock of fans. Jobbers themselves are not stocking more fans than they feel certain they can handle during this year, because they feel that 1920 will bring a price reduction in fans, and they do not care to be caught carrying stock over the year.

SCHEDULE MATERIAL.—There is very little movement in schedule material at the present time. Even manufacturers of fixtures are not buying sockets.

SECOND-HAND APPARATUS.—Dealers in second-hand apparatus are very optimistic about the business of the present time, stating that orders for the medium-size and small equipment continue to come in in good volume. The volume of business in some quarters is reported to be almost equal to war-time business owing to the demand for this small class of goods. The demand seems to have changed from a majority in favor of alternating-current motors to a heavier demand in favor of direct-current motors.

ICE MACHINERY.—One manufacturer recently secured an order for $132,000 worth of ice machinery in Chicago. Other ice plants are making improvements as rapidly as possible since the coming summer seems to be destined to produce an exceptional artificial-ice business.

WIRING DEVICES.—Jobbers profess to see a state of weakness in the market for these goods and predict rather freely that there will be some reduction in price in the near future.

WASHING MACHINES.—The demand for washing machines appears to be in no wise abating, the main difficulty in the industry being one of delivery. The design of machines appears to be undergoing the first stages of a change in which there is an attempt to incorporate more of an element of style and good appearance with satisfactory mechanical operation.

ELECTRIC RANGES.—One Middle Western central-station company has bought 1500 electric ranges, expecting to install them upon its lines in the coming spring and summer season.

ATLANTA

The general situation looks favorable, and activity in certain lines is increasing. There is more or less hesitancy on the part of buyers, due to the present agitation of price reduction on steel and basic metals. Building operations are assuming a larger scope, and the lack of housing facilities in a number of Southeastern cities has further tended to stimulate apartment-house construction. An organization of a cotton corporation for $200,000,000 is of interest from a credit and collection viewpoint, as the general cotton market, together with the financial aspects, has considerable bearing on the Southeastern electrical interests indirectly.

FARM-LIGHTING OUTFITS.—The volume of sales is reaching large totals. Comparisons from week to week show big gains, and the present outlook is bright for a continued growth in demand for this product. While a large area of this section has been covered, there still remains territory that has not been scratched and distributers are becoming more active in placing agents covering a wide and well-balanced area. All interests are alive to the fact that a potential market exists for a full line of supplies, and dealer-contractors are arranging to take care of profitable inquiries that are increasing. On the whole, factory shipments are very satisfactory, and better deliveries are being promised.

ELECTRIC CHURNS.—A steady demand is observed, with an increasing number of inquiries and orders from the central-station cities of 1500 to 5000 population. Retail sales in the larger cities are much better than at the same period last year. Prices are holding up well. Factory shipments are excellent, and local stocks appear to be ample to handle the present demand.

WIRE.—Rubber-covered holds on a 20-cent base. The movement this week showed signs of increasing activity. A greater call for weatherproof is noted. In fact, the total transactions may be safely put as 30 per cent over those of the previous week. Stocks are in good condition and being amply filled by improved shipments from Eastern points. The circular-mil sizes and heavier cables are especially active, and jobbers report an improved spot demand. An analysis of sales shows that the buying element is taking more interest in present-day quotations and making purchases now that for a time it was thought would be postponed anticipating further declines in the basic metal.

SCHEDULE MATERIAL.—Industrial buying is comparatively light, and sales are not much better than from hand to mouth. The volume is well maintained, however, and the condition is fairly satisfactory under present circumstances; but manufacturers complain of the lack of big future orders. The general opinion prevails in purchasing quarters that prices are going to seek lower levels, and until a reduction does come or buyers are finally convinced that no material change will take place no large movement can be expected. Stocks in most places are reaching normal conditions; that is, covering jobbers' ordinary turnover. No complaint is heard regarding shipment, and outlying distribution is well up to standard.

SOCKET APPLIANCES.—For this time of year all heating and labor-saving devices are going strong and retail sales show nominal gains compared with 1918. The increasing temperature coincident with better factory facilities and greater production has tended to weaken prices on circular radiant heaters about $1 per unit. Irons are off 50 cents in the face of larger sales. Washing machines and vacuum cleaners are in great demand, and no change in price is recorded. Percolators are beginning to show some life, and toasters are moving fairly well.

SEATTLE—PORTLAND

The volume of business which has been handled for the past month shows no particular change in spite of predictions that early spring would show a noticeable increase in new building projects and new industrial enterprises. From present indications it will be several months or even longer before the larger industrial projects really materialize. In some cases particularly applying to machinery manufacturing establishments the uncertainty of the government's attitude regarding cancellation of existing contracts with shipyards and letting of new contracts is given as the reason. Lumber production and movement is comparatively satisfactory, although the mills and camps are not producing to the extent originally expected. It was announced recently that steel ship contracts held by Seattle yards, which were canceled during the recent strike, will be reinstated. This order affects four large plants in Seattle and involves more than thirty vessels. Dealers' reports for the week show a well-sustained volume of sales of domestic appliances, particularly washing machines and electric ranges. Fixtures and house-wiring devices moved a shade faster. The Spokane territory reports that the wholesale trade is picking up and that the retail trade is good with brisk demand for domestic appliances. Collections are fair in Spokane and outlying districts. The demand for farm labor cannot be filled. The Portland district reports that business generally is dull in the electrical field. This condition is particularly noticeable along the line of industrial equipment. The greatest activity at the present time is in household appliances. Reports indicate that there is a large movement in washing machines and kindred appliances, but the general impression seems to be that total sales in these lines are no greater than they were a year ago. The number of small automobile tire shops which have sprung up in the last few weeks have provided a marked outlet for small motors. A constant increase is noted in the amount of residence construction.

PORCELAIN.—A slight increase in demand is noted, but stocks on hand are sufficient to meet any emergency. Prices are steady, although a decrease would not be unexpected. Movement of high-tension insulators for maintenance only is noted.

CONDUIT.—Sales show a slight increase, particularly in the smaller sizes. No change in prices has been noted for some time, although reductions are expected. In Seattle especially stocks are in good condition.

SAN FRANCISCO

Most of the prominent electrical men are preparing to attend the big Santa Barbara convention, and a proportion of the remainder are out canvassing for Victory Liberty Loan subscriptions, so that business will be more or less of a passive character for the next three weeks.

Building operations are piling up ready for actual work. There is reported a project of $3,000,000 for reconstruction of the University of Southern California in a series of six buildings, and for ferry improvements in San Francisco of considerable size.

HEATING MATERIAL.—General Electric and Hotpoint irons have been slightly reduced in price, the 6-lb. size now listing at $6.50. This change created considerable activity. Soldering irons, glue pots and other industrial devices have advanced from 15 to 20 per cent.

RANGES.—Power companies are intending to begin an active campaign on electric ranges with the coöperation of electrical dealers. A tentative campaign allowing the dealer to carry the account or turn it over to the power company for handling at a smaller profit is under way. A 3-cent range rate is now effective in San Francisco.

VACUUM CLEANERS.—The season is the best ever reported, with many new makes out. In this connection the California coöperative campaign committee is securing solicitors to be sent to electrical dealers who will guarantee the solicitor a minimum weekly wage of $25, to be based upon a commission of 15 per cent on the sale of each motor-driven device and 20 per cent on the sale of each heating device. The dealer makes up the difference if the commission falls short of $25. The scheme so far has worked exceedingly well, the difficulty being to get enough competent solicitors to take care of the applications for them.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid	
Less than coil	20%
Coil to 1000 ft	25%
No. 12 Solid	
Less than coil	20%
Coil to 1000 ft	25%

Twin-Conductor

No. 14 Solid	
Less than coil	20%
Coil to 1000 ft	25%
No. 12 Solid	
Less than coil	20%
Coil to 1000 ft	25%

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid	
Less than coil	+20%
Coil to 1000 ft	List
No. 12 Solid	
Less than coil	+20%
Coil to 1000 ft	List

Twin-Conductor

No. 14 Solid	
Less than coil	$115.00
Coil to 1000 ft	100.00
No. 12 Solid	
Less than coil	+20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to List
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 36%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.35 to $0.362	.35 to .372
Barrel lots	.326 to .332	.326 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
⅝	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25 to $78.75	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
5/16	.09	1½	.40
⅜	.12	1¾	.47
7/16	.15	2	.55
½	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25.00	$18.00	$16.00
¼-in.—	30.00	19.50	17.50

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60.00	$30.00	$26.00–26.50
¼-in.—	65.00	32.00–32.50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ⅜ in.	½ in. to 3 in.
Less than 2500 lb.	7% to 12.1%	9% to 14.1%
2500 to 5000 lb.	10% to 15.1%	12% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ⅜ In.	½ to 3 In.
Less than 2500 lb.	+3%	+1% to 2%
2500 to 5000 lb.	+1% to 2%	+4%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$7.00 to $7.50
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.50
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.18
Coil to 1000 ft.	25.94

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$31.00—$36.00
Coil to 1000 ft.	24.00— 27.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$33.00

CHICAGO

Net per 100	$33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%–32%	10%–27%
$10.00 to $50.00 list	30%–40%	20%–35%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	5%
1/5 to std. pkg.	15%
Std. pkg.	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.00 to $17.00
1/5 to std. pkg.	12.00 to 14.00
Standard package, 2200. List per 1000, $21 to $34	

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$21.00–$24.15
1/5 to std. pkg.	17.85– 21.00
Standard package, 2200. List per 1000,	$20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$16.00	$22.00
1/5 to std. pkg.	13.60	18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$13.00–$18.40	$32.00–$36.80
1/5 to std. pkg.	11.50– 16.00	27.20– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 std. pkg.	List to 10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%+15%
$10 to $25 list	+10% to 2%
$25 to $50 list	+5% to 5%
	Low Grade
Less than $10 list	+15% to +5%
$10 to $25 list	2% to 8%
$25 to $50 list	5% to 15%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+30% to list
1/5 to std. pkg.	+5% to 10%
Std. pkg.	8% to 18%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%	List
$2.00 to $10.00 list	28%	5%
$10.00 to $50.00 list	45%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $6.50
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.50
Discount	20% to 30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.39
No. 18, full spools	.37

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.53 to $0.90
No. 18, full spools	.47 to .64

WIRE, RUBBER-COVERED, N. C

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.15–$14.50	$10.50–$12.65	$10.50–$10.60
12	$18.18	18.18	$13.64
10	24.30	24.30	16.20
8	33.12	27.60	22.08
6	52.50	43.75	35.00

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.00–$20.00	$13.00–$15.00	$11.50–$13.00
12	17.50– 21.63	17.55– 21.63	17.55– 18.54
10	24.05– 28.91	24.05– 28.91	21.16– 24.78
8	33.35– 39.34	33.35– 33.72	29.35– 33.72
6	52.95– 61.74	46.60– 52.92	46.60– 52.92

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$24.00
25 to 50 lb.	24.00
50 to 100 lb.	23.00

CHICAGO

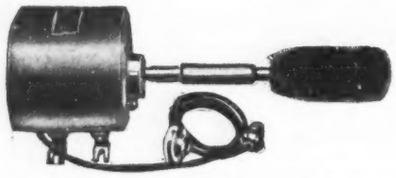
	Per 100 Lb. Net
Less than 25 lb.	$23.75 to $35.75
25 to 50 lb.	23.75 to 34.75
50 to 100 lb.	23.75 to 37.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Electric Milk-Bottle Washer

As a quick and efficient means of washing milk bottles at dairies an electrically driven bottle washer is being offered by the Electric Specialty Company, Stamford, Conn. In using the



IRON SHIELD PROTECTS MOTOR WINDINGS FROM MOISTURE

washer it is mounted so that the brush rotates over a tub of water. The bottles are filled about half full of water and forced over the brush, which rotates at a high speed, coming in contact with all parts of the bottle's interior and cleaning it thoroughly.

The motor used to rotate the brush is of ⅛-hp. rating and is said to be capable of withstanding a heavy overload. Less power is consumed by it than by two standard 16-cp. incandescent lamps. The motor is of rugged and durable design and is equipped with an iron shield to protect the windings from moisture. Connection may be made with any lamp socket since a plug and 6 ft. (1.8 m.) of cord are provided with the washer.

Motor Generator for Mine Substation

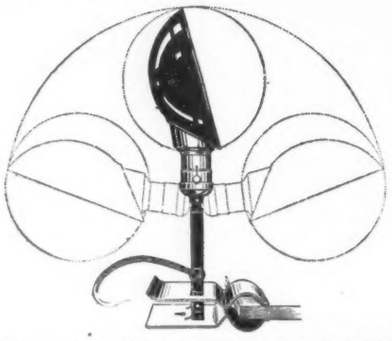
For mine substation use a synchronous motor-generator set which embodies the continuous power-factor correction common to such sets with very high overload and "peak" capacity has recently been put on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It consists of a three phase, 60-cycle synchronous motor driving a 150-275-volt compound generator. The machine has three bearings, the pedestals and field frames being mounted on a common bed plate. The compound field is adjusted to give 19 per cent increase in voltage from no load to full load.

In addition to commutating poles of the generator, there is a compensating winding placed in slots in the faces of the main poles. This gives extremely good commutating characteristics and consists of but one continuous coil per pole. Each coil is put into open slots in the pole faces, where it is held by wedges. This construction gives one joint per pole instead of two joints per conductor. No difficulty is found in removing and replacing coils.

The motor is a six-pole revolving-field machine, provided with squirrel-cage damper winding in the pole faces. This permits starting the set from the alternating-current side and also insures its stability under sudden variation of load. The field may be over-excited to draw "leading" reactive current from the line, thus compensating for the "lagging" current.

Adjustable Portable Lamp

The important feature of the "600" adjustable and portable lamp recently brought out by S. W. Farber of 141 South Fifth Street, Brooklyn, N. Y., is a clip which enables the lamp to be clamped on any projecting edge or post. Also the lamp may be hung on the wall or placed on a flat surface, using the clip as a base. Since practically all articles of furniture have either an



CLAMPS ON EDGES OR POSTS, HANGS FROM WALL OR USES CLIP AS BASE

edge, a post or a flat surface, it is possible to use this lamp almost anywhere. As the clamp is felt-lined, there is no danger of scratching or denting polished surfaces. The lamp is equipped with a Bryant push-button socket, uses a standard bulb and comes complete with 6 ft. (1.8 m.) of silk cord and an attachment plug. Finishes of brushed brass, statuary bronze, nickel and silver plate are obtainable.

One-Piece Night Lamp

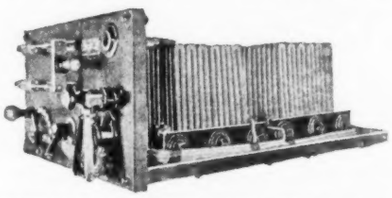
For nurseries, sick rooms, halls, bedrooms and wherever a night lamp is desirable the "Baby Light" is offered by the St. Louis Brass Manufacturing Company, St. Louis, Mo. It is about 6 in. (15 cm.) high and 5 in. (13 cm.) wide and is made in one piece of white glazed porcelain. A 2-cp., 6-volt automobile-type bulb is used, energy being supplied through a transformer in the base of the lamp from an ordinary 115-volt, 60-cycle alternating-current lighting circuit. The amount of light furnished, the maker says, is not enough to disturb sleeping persons, but is adequate to illumine objects that are likely to be tripped over otherwise. Since the base of the lamp is broad, there is no danger of its tipping over.

Wire Grip with Automatic Locking Device

An automatic locking device is the feature of the improved Buffalo wire grip No. 471 made by the Smith & Hemenway Company, 114 Coit Street, Irvington, N. J., and which will be ready for distribution about the middle of next month. By throwing the loop of this tool in an upright position the grip is locked open so that the lineman or electrician can handle it with one hand. When the pull or strain is placed on the loop it automatically engages the telegraph, telephone or electric light wire being stretched. This improvement will also be placed on grips with loops or with double pulleys. The tool is made of high-carbon cold-rolled steel, white-nickel-plated, and is supplied in three sizes, one for No. 6 wire and smaller, another for No. 0 wire and smaller, and the third for No. 000 wire and smaller.

Sectional Automatic Battery-Charging Equipment

Simplicity of installation and flexibility of usage are said to characterize the Unipanel automatic sectional battery-charging equipment now being manufactured by the Automatic Electrical Device Company, 120 Opera Place, Cincinnati, Ohio. Each section



SECTIONS ARE WIRED COMPLETELY, WITH LINE AND BATTERY TERMINALS BROUGHT TO BOARD

is equipped with a heavy double-pole fused knife switch, adjustable rheostat shunt-trip circuit breaker arranged for automatic operation from ampere-hour meter, special meter switch, special arrangement for series charging of Edi-

son batteries, and indicating lamp for showing to which section a particular battery is connected. Furnished for charging either lead or Edison batteries, these sections are wired completely with line and battery terminals brought to a terminal board at the rear of each section and standardized busbars furnished to connect the various sections together. To install additional panels these are inserted into the standard angle-iron frame and interconnected with the standardized busbars at the rear.

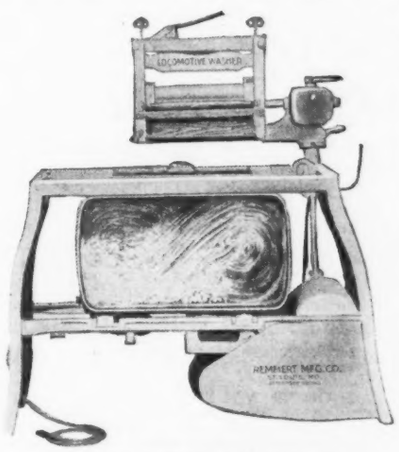
Through the use of a special meter switch only one meter section is required for a number of charging sections, this number being limited only by the attendant's ability to read the meter from a distance.

Swinging-Pivot Flood Lamp

To permit changes in divergence of light rays for floodlighting purposes, the bulb of the unit being manufactured by the Pittsburgh Reflector & Illuminating Company, Pittsburgh, Pa., is arranged to be adjustable so that its filament lies in the exact focus of a specially designed silvered-glass reflector. The door of this device can be opened on its hinge, swinging in a horizontal plane upon the withdrawal of a pin at either side. It is furnished either with a base standard or with a side-arm bracket.

Reciprocating-Tub Washing Machine

The clothes-holding tub of a motor-driven washing machine recently placed on the market by the Remmert Manufacturing Company, Belleville, Ill., has no internal moving mechanism but reciprocates on a horizontal plane, thereby forcing the water through the fabric of the clothes and cleaning without tearing or injuring them. A



WATER IS KEPT MOVING BY RECIPROCATING ACTION

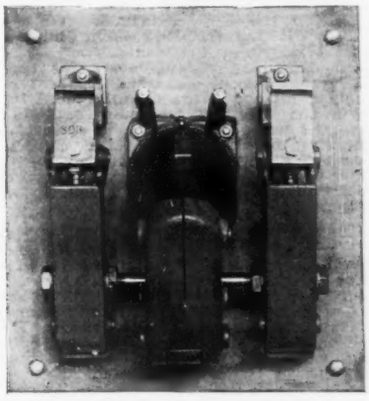
gas heater is provided to keep the water constantly at the boiling point. The machine has a capacity of eight sheets and is equipped with a swinging wringer. Motor and driving mechanism are completely inclosed.

Hand-Power Metal Punch

A deep throat which allows use of large material, a one-piece automatic disappearing stripper, crowned punches of the floating type that direct the power to the center, and the fact that it will not twist or turn in operation, are the features of the "Jiffy" hand-power punch recently developed for cutting holes in metal up to No. 10 gage. It will cut holes $\frac{5}{32}$ in. (3.9 mm.), $\frac{3}{16}$ in. (4.7 mm.), $\frac{7}{32}$ in. (5.5 mm.) and $\frac{1}{4}$ in. (6.3 mm.) in diameter. The weight of the punch is 5 lb. (2 kg.) and its length is $9\frac{1}{2}$ in. (30 cm.). Paul W. Koch & Company, 19 South Wells Street, Chicago, market this punch, which may be operated either entirely by hand or clamped in a vise.

Two-Pole-Magnet Contactor for Heavy Service

The two-pole-magnet contactor which is a recent addition to the products of the Automatic Switch Company, 4 White Street, New York City,



HEAT AT ARCING CONTACT DOES NOT BLISTER CONTACTING ELEMENT

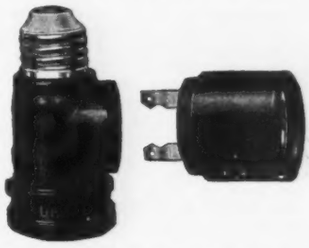
is especially fitted for heavy, continuous alternating-current service. The contacts of this device are so constructed that the arcing elements are some distance from the contacting elements. In this way the latter cannot be affected by the heat occurring from opening and closing the contacts.

Washer with Automatic Stop and Lock

An automatic stop and lock on its washing drum are pointed out as important features of a clothes-washing machine recently developed by the Fosston-Carpenter Company, 473 Cleveland Avenue North, St. Paul, Minn. By placing the automatic lever in a vertical position the drum is automatically stopped with its cover in line with the wringer, ready for removing and wringing out the clothes. This device also locks the drum in this position, so that if the machine is accidentally started while the operator's arm is in the drum no injury will result. Other features of the machine are adjustable legs and an automatic friction release which allows the motor to revolve freely in case the machine is started under an overload sufficient to damage the motor.

Combined Current Tap and Lamp Receptacle

The wiring devices manufactured by Harvey Hubbell, Inc., Bridgeport, Conn., have been recently supplemented by the addition of the No. 6700 current tap, which is a combination of a current-tap body and a lamp receptacle, both made of heat-resisting composition. Not only is an extra source of



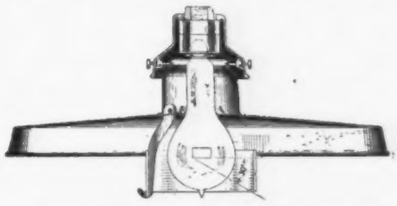
TAP TAKES ONE-PIECE SCREW-BASE PLUGS

current supply provided without interrupting the service from the lamp, but the additional outlet will take all standard plug caps or any one-piece screw-base plug. Another feature is found in the fact that the lamp hangs in the correct vertical position and the tap is so designed as to allow the use of glass or metal reflectors.

Wide-Distribution, Glareless Industrial Lighting Unit

The desirable qualities of a shallow-bowl-type reflector — namely, wide distribution and an extensive area of light source—are combined with the eye protection of deep-bowl equipment in "Factorylite" No. 800, now being manufactured by the Henkel & Best Company of Chicago and distributed by the Federal Sign System (Electric), Lake and Desplaines Streets, Chicago.

These fixtures can be spaced at two and a half times the mounting height from the working plane. Two sizes of the units are obtainable, one for lamps



CROSS-SECTION SHOWING OPAL-GLASS DIFFUSING RING AND HANGER

of 200 watts and the other for 300-500-watt bulbs. The reflector is made of porcelain enamel and is finished in green outside and white inside. An opal-glass diffuser ring is suspended from the reflector by hangers. The unit can be used with any standard porcelain socket and 3¼-in. (8-cm.) flat shade holder.

Trade Notes

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A man in Switzerland (No. 28,975) desires to secure an agency for the sale of electrical apparatus.

A man in Italy (No. 29,052) desires to secure an agency for the sale of electric lamps and electrical machinery.

A company in Norway (No. 29,062) desires to purchase and to secure an agency for the sale of electrical supplies. Payment will be made against documents.

A man in Norway (No. 29.045) desires to purchase and secure an agency for the sale of electrical industry supplies. Terms, cash against documents in Norway.

A firm in Spain (No. 29,079) desires to purchase electrical machinery. Quotations should be f.o.b. New York. Payment, cash against documents. Correspondence should be in Spanish.

The manager of a trading corporation in Belgium (No. 29,090) desires to be placed in touch with manufacturers able to supply all kinds of electrical machinery, fittings and apparatus.

A merchant in France (No. 28,959) desires to represent manufacturers and exporters for the sale of machinery and materials for electrical plants. Correspondence may be in English.

An electrical machinery manufacturer in France (No. 29,088) desires to secure an agency, on a salary and commission basis, for the sale of electrical products. Correspondence may be in English.

A business man in France (No. 29,017) desires to secure an agency for the sale in France, Belgium, Italy and Switzerland of electrical apparatus used by barbers, hairdressers and manicurists. He states that he has space in which to store a stock of goods. Correspondence may be in English.

A business man in Norway (No. 28,960) desires to secure an agency for the sale of electrical motors, transformers, storage batteries, dry cells, wires, cables, resistance alloys, apparatus for cooking and heating, insulators, insulating materials, tapes and other electrical supplies; also varnish, carbon and metal brushes, metals, transformer and dynamo plates, tools, etc.

Daniel T. Pierce, formerly assistant to the president of the General Asphalt Company, who has just returned from more than a year's service in France, is established temporarily at Room 1031, 120 Broadway, New York. Mr. Pierce will represent important Franco-Italian interests as well as acting for American manufacturers seeking business in France and other European countries.

H. W. Butler, of Cravon House, Kingsway, London, England, is staying at the Manhattan Hotel, Forty-second Street, New York City, and will be glad to hear from manufacturers of small electrical tools, fractional-horsepower motors and varnished-fabric and paper insulating materials, with the view of development of trade in European markets. Mr. Butler is well known in English trade circles, having been chairman of the British Electrical Manufacturers' Association for two years from 1910 to 1912 and also chairman of the organizing committee of the last electrical exhibition held in England, in 1911.

NEW SERVICE BUILDING FOR NATIONAL LAMP WORKS.—The National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio, are preparing plans for a new service building at Nela Park, which will cost upward of $200,000, it is reported. The expectation is to construct it this year. The building will include a larger cafeteria, the dispensary, rest rooms for employees and space for the treasury and accounting departments. Later a wing may be added to include a library and possibly some recreation facilities for employees, but that construction will not be made this year. A new laboratory also is contemplated, but decision to build it has not yet been reached.

METAL STATISTICS FOR 1919—The American Metal Market and Daily Iron and Steel Report, New York, has issued its twelfth annual edition of "Metal Statistics." The preface states that "there is now so much interest in what occurs during and after wars that attention may be directed to the long span of some of these tables."

ROUMANIAN TRADE INTERESTS.—The American-Roumanian Chamber of Commerce has been formed, with headquarters at the Woolworth Building, New York City, to assist American business interests in the development of important opportunities in connection with the reconstruction of Roumanian industrial and commercial life.

RESTRICTION ON EXPORTS TO GERMAN AUSTRIA.—Announcement is made that after April 2 applications will be considered to export or import all commodities to or from German Austria, except that, for military reasons, the importation into German Austria of electrical appliances adapted for use in the war and their component parts will be restricted, and export licenses for these articles will be granted only in exceptional cases.

WEBER SNAP-SHELL PATENTS UPHELD.—Judge Thomas, in the United States District Court, Connecticut, has upheld the Weber Electric Company snap-shell patents against the Connecticut sockets of the Connecticut Electric Manufacturing Company. This is similar to the action sustaining these patents against the Cutler-Hammer Manufacturing Company, decided Jan. 22, 1919, and noted on page 706 of the April 5 issue of the ELECTRICAL WORLD.

ENGLAND'S DISPOSAL OF WAR ELECTRICAL STORES.—The English Disposal Board of the Ministry of Munitions has completed arrangements for the sale of quantities of electrical apparatus and equipment that were manufactured to help win the war and are now available for peace-time development. The stores include lighting accessories and fans, cables, bell materials, electrical instruments, telegraph and telephone materials, wireless apparatus, searchlights, arc lamps and equipment and plants.

FOREIGN TRADE EDUCATIONAL COMMITTEE.—In furtherance of a resolution adopted at the last annual convention of the American Manufacturers' Export Association the board of directors has appointed the following committee on education for foreign trade service: W. W. Nichols, Allis-Chalmers Manufacturing Company; G. H. Carter, W. R. Grace & Company; H. E. Cole, Standard Oil Company; H. H. Merrick, Chicago Association of Commerce; H. S. Smith, Gulf States Steel Company; E. P. Thomas, United States Steel Products Company.

THE PACIFIC DIVISION, Electrical Supply Jobbers' Association, will hold its meetings May 28-29.

THE LEONARD ELECTRIC MANUFACTURING COMPANY, Cleveland, Ohio, is the new name of the Leonard-Bundy Electric Company.

THE POWER SPECIALTY COMPANY, Dansville, N. Y., manufacturer of Foster superheaters, is arranging for the manufacture of a new fuel-saving device now being developed.

THE PAGE STEEL & WIRE COMPANY, with its main plant at Monessen, Pa., has, it is reported, put all departments on an eight-hour-day basis in order that more men may be employed.

C. E HAGUE, formerly production engineer of the Mid-West Engine Company, Indianapolis, Ind., has been appointed sales manager of the American Steam Conveyor Corporation, Chicago, manufacturer of steam ash conveyors and other ash-handling equipment.

CARLISLE MASON, INC., 207 Broadway, New York City, and 81 Rue St. Lazaire, Paris, consulting engineers, announce that Major Mason, having returned from France and resigned his commission, will resume his practice of general engineering in a consulting capacity, assisted by a staff in the specialized branches.

THE ELECTRIC FURNACE CONSTRUCTION COMPANY, Finance Building, Philadelphia, reports the successful starting up of a "Greaves-Etchells" electric furnace at the plant of the Davidson Tool Manufacturing Corporation, Brooklyn, N. Y. This furnace is used in conjunction with Mr. Davidson's special process for the manufacture of high-speed steel castings. The company also reports the starting up of a 6-ton furnace at the Mare Island Navy Yard. In England Greaves-Etchells furnaces have been started up for the Tyne Electric Steel Foundries, Ltd., for the manufacture of steel castings, and a special 6-ton furnace has been installed for W. W. McGregor of Airdrie, for the manufacture of alundum.

THE MULTIPLE STORAGE BATTERY COMPANY, New York City, has arranged for the construction of a new plant, 60 ft. by 120 ft., at Jamaica, L. I.

ROY BURLEW, formerly with the Novelty Company, Emporium, Pa., is one of the purchasers of the Kentucky Electric Lamp Company, Owensboro, Ky. M. E. Pierson, formerly general superintendent of the Novelty Company, is directly in charge of operation in the lamp company.

THE HOME SPECIALTY COMPANY, Cleveland, Ohio, maker of the Laun-Dry-Ette" washing and drying machine, announces the awarding of the contract for a new factory to be built and completed in May. The new plant will be of brick fireproof construction and will increase the output.

THE A. P. GREEN FIRE BRICK COMPANY of Mexico, Mo., has opened an Eastern district sales office in New York City at 30 Church Street. Howard C. Thayer, formerly field mechanical engineer for the J. G. White Engineering Corporation at the United States nitrate plant No. 2, is in charge.

J. T. GIBSON, who has been appointed sales manager of the One-Minute Manufacturing Company, Newton, Iowa, was assistant and branch manager of the International Harvester Company at Des Moines, Iowa, for eight years. Prior to that he was connected with the same company at Kansas City and other points in the Southwest territory.

THE HOME MANUFACTURING COMPANY, Brooklyn, N. Y., has established a branch office at 222 Grand Trunk Dock, Seattle, Wash. The company is considering the establishment of a factory in Seattle for the manufacture of electrical equipment of various kinds and is looking over the field with this end in view. Details of site and plant will be available later.

S. J. STEWART (ELECTRIC), New Orleans, La., announces the completion of twenty years in the business of repairing and rebuilding of electrical equipment and the manufacture of switchboards. There is also a retail department and construction department connected with the shop. Starting with a 10-ft. by 10-ft. back-yard shed, the space occupied is now a four-story structure on Carondelet Street.

THE GELLERT ENGINEERING COMPANY, Philadelphia, is erecting electrical precipitators at the plant of the American Manganese Manufacturing Company at Dunbar, Pa., for the purpose of cleaning the gases from its blast furnaces. Erection of these precipitators will be completed about June 1. The Gellert Engineering Company has just completed tests made with a small precipitator at the plant of the Woodstock Operating Corporation, Anniston, Ala.

THE ALLOY METAL WIRE COMPANY, INC., New York City, has leased the two-story factory building at No. 10 and 12 Woodworth Avenue, Yonkers, N. Y., for a term of years for the manufacture of electrical resistance wire, pure nickel, monel metal, spark plug wire, bronze, brass and copper. S. A. Murray, president and general mill manager, was until recently engaged as wire-mill superintendent for the Electrical Alloy Company of Morristown, N. J., and prior to that time was for a period of ten years employed in a like capacity for the Driver-Harris Company of Harrison, N. J.

GEORGE W. HUBLEY, who recently terminated his office as administrative engineer and chief of conservation, United States Fuel Administration, has opened an office in the Starks Building, Louisville, Ky., as consulting and advisory engineer and power plant specialist. Previously Mr. Hubley was general manager and chief engineer of the Merchants' Heat & Light Company of Indianapolis, Ind., and was identified for a number of years with the public utility interests at Louisville. In addition, his organization will be prepared to take care of general consulting engineering practice, making surveys, investigations, appraisals, reports, plans and specifications.

THE HOWE SPECIALTY COMPANY, Cleveland, Ohio, has let contracts for a factory building to cost $70,000.

THE MOTOR PROTECTOR MANUFACTURING COMPANY of San Francisco, Cal., is the new name of the Baruch Electric Controller Corporation.

HENRY D. SEARS, general sales agent of the Weber Electric Company, announces the removal of the district sales office to 345 Fifth Avenue, New York City.

THE BROWN-HUNKELE CORPORATION, 12 Mechanic Street, Newark, N. J., manufacturer of motors, has increased its capital from $30,000 to $100,000 for expansion.

THE LANGSTADT & MEYER COMPANY of Appleton, Wis., it is reported, is contemplating the erection of a factory and shop for the manufacture of farm-lighting-systems and appliances.

J. D. MOONEY, formerly manager of the Hyatt Roller Bearing Company's industrial division, has been discharged from the service and become connected with the General Motors Corporation, New York City.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., announces the transfer of E. C. Cherrington to the Pittsburgh office of the central district as office manager, and of T. R. Cooley to the same office as engineering correspondent.

G. H. COHEN, formerly sales manager of the Wesco Supply Company, St. Louis, has resigned to become vice-president and general manager of the Fidelity Electric Company, which is a new corporation organized to engage in the electrical jobbing business.

THE CHICAGO PNEUMATIC TOOL COMPANY has moved its Milwaukee office from Room 1305 Majestic Building to Room 1418 in the same building, where more convenient quarters necessitated by the growing business of the company in that district have been obtained.

THE OKONITE COMPANY announces that its entire executive staff was transferred on April 1 from 501 Fifth Avenue, New York City, to the company's plant at Passaic, N. J., where the main office will hereafter be located. A sales office will be retained at 501 Fifth Avenue, New York.

THE VAN DORN ELECTRIC TOOL COMPANY, Cleveland, Ohio, will soon erect a four-story addition to its plant. The new plant, like the present factory, will be devoted entirely to the making of portable electric drills and grinders. All parts of the specially designed motors are made in the plant.

P. C. GUNION has been appointed advertising manager of the industrial divisions, General Motors Corporation, according to the announcement of D. Gleisen, chairman board of managers of the industrial divisions, General Motors Corporation, New York City, and manager industrial bearings division of the Hyatt Roller Bearing Company.

LIEUT.-COMMANDER H. J. ELSON, United States Naval Reserve Force, has been released to inactive status and has resumed his civilian work as secretary and treasurer of the Walter A. Zelnicker Supply Company, St. Louis, where he is in charge of internal management and manufacturing operations. His assignment was inspector of machinery, Ninth, Tenth and Eleventh Naval Districts, with headquarters at Chicago, where he had charge of the design and conversion to salt-water use of the machinery department of Great Lakes vessels taken over by the Navy Department.

THE ELECTRO-DYNAMIC COMPANY of Bayonne, N. J., has bought the business of the Stamford Electric & Manufacturing Company, Stamford, Conn., and will continue the manufacture of the alternating-current motor heretofore manufactured by the Stamford company. The purchase does not include the Stamford company's factory building. Edward Heitman, president and general manager of the Stamford company, will be associated with the Bayonne company as chief engineer in the production of the motor he designed. Until now the Bayonne company has made only direct-current motors of standard type up to 150 hp. and motors of 400 hp. to 1000 hp., interpole type, for the main driving motors of submarines. The alternating-current motors in sizes from ¼ hp. to 50 hp. are ready for immediate delivery to the purchasers.

Trade Publications

BOTTLE WASHER.—An electrically driven milk-bottle washer is the subject of a circular from the Electric Specialty Company of Stamford, Conn.

MALLEABLE IRON.—The American Malleable Castings Association, 1900 Euclid Building, Cleveland, Ohio, announces a publication on malleable iron.

LIGHTING PLANTS.—Automatic lighting plants are the subject of a recently issued circular of the Mathews Engineering Company, Sandusky, Ohio.

INDICATING INSTRUMENTS.—Descriptive matter on type W duplex indicating instruments is contained in a new booklet from the Esterline Company of Indianapolis, Ind.

LAMP GUARDS.—Lamp guards and lamp guards for portable uses are illustrated and described in a circular prepared by the McGill Manufacturing Company of Valparaiso, Ind.

FUSED OIL SWITCHES.—The type N-2 fused oil switches made by the Condit Electrical Manufacturing Company of South Boston, Mass., are described in bulletin No. 440, now being distributed.

GENERATOR BRUSHES.—The Corliss Carbon Company, Bradford, Pa., manufacturer of motor and generator brushes, has just published bulletin No. 6, which gives data in condensed form on brushes.

DISCONNECTING HANGERS.—"How to Make Reflectors Reflect" is the title of a circular on disconnecting hangers being distributed by the Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio.

SIGN FLASHERS.—Bulletin No. 36, dated March 15, 1919, issued by the Reynolds Electric Company, 422 South Talman Avenue, Chicago, is devoted to information on Reco flashers for electrical signs and displays.

ELECTRIC HOISTS.—The Electric Hoist Manufacturers' Association, 9 West Fortieth Street, New York City, has issued an illustrated booklet called "The Strong Arm of Industry," which contains general information about electric hoists.

RADIOTELEGRAPHY.—"The Wonderful Achievements of Radiotelegraphy in War and Peace" is the title of an interesting thirty-page booklet written by William Dubilier of New York City, which also contains a discussion of the Dubilier condenser.

INDUSTRIAL LIGHTING FIXTURE.—The Amco industrial lighting unit is the subject of a recently issued folder of the Art Metal Manufacturing Company, East Sixty-first Street and Curtis Avenue, Cleveland, Ohio.

ATTACHMENT PLUGS.—Superseding bulletin No. 16-4, bulletin No. 16-9, dated March, 1919, has been issued by Harvey Hubbell, Inc., Bridgeport, Conn. It catalogs composition attachment plugs for small motors and heavy-duty polarized attachment plugs.

AUTOMOTIVE ELECTRIC EQUIPMENT.—The subject of publication 1532-E from the Westinghouse Electric & Manufacturing Company, 110 West Forty-second Street, New York City, is automotive electric equipment for automobiles, airplanes, trucks, motorboats, tractors and locomotives.

BATTERY-CHARGING EQUIPMENT.—Bulletin No. 601 prepared by the Automatic Electrical Devices Company, 120 Opera Place, Cincinnati, Ohio, tells about its "Unipanel" sectional automatic battery-charging equipment for industrial trucks, tractors and engines. The "Chargometer" is also described in this publication.

IRON RODS AND WIRE FOR WELDING.—The Page Steel & Wire Company, 30 Church Street, New York City, has prepared an interesting sixty-page booklet entitled "Armco Iron Rods and Wire for Oxy-acetylene and Electric Welding." A large portion of its contents are of handbook character. Many tables and information on welding are included.

HIGH-VOLTAGE PROTECTIVE AND SWITCHING EQUIPMENT.—Schweitzer & Conrad, 4431 Ravenswood Avenue, Chicago, are distributing a new catalog describing their high-voltage protective and switching equipment. Among the apparatus described in the catalog are high-voltage fuses, safety disconnecting switches, fuse mountings, choke coils, protective combinations, fuse tongs, switch sticks, high-voltage circuit breakers, cut-outs, lightning arresters, voltage detectors, multiple-circuit relays, differential relays, reverse-phase relays, recording synchroscopes, etc. The catalog has five sections and is well illustrated.

New Incorporations

THE FOREMAN (ARK.) LIGHT & WATER COMPANY has been chartered with a capital stock of $25,000 to construct and operate an electric light plant in Foreman.

THE CLIO (KY.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $3,000 by A. L. Calhoun, Jr., J. G. McRae and W. J. Rabon.

THE CLARKSVILLE (TEX.) BATTERY & ELECTRIC COMPANY has been incorporated with a capital stock of $3,000 by W. A. Collins, W. G. Moore and Wortham Collins.

THE GHENT (KY.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of $5,000 to construct and operate an electric lighting system in Ghent.

THE NORTHERN OHIO HYDRO-ELECTRIC COMPANY of Cleveland, Ohio, has been incorporated by George R. McKay and Raymond Bolivar. The company is capitalized at $300,000.

THE RECTOR ELECTRIC COMPANY of New York, N. Y., has been incorporated by W. Claman, A. Goetz and F. W. Martin. The company is capitalized at $10,000 and proposes to manufacture electrical appliances and equipment.

THE TITAN BATTERY SERVICE COMPANY of Trenton, N. J., has been chartered with a capital stock of $25,000 to manufacture storage batteries. The incorporators are Norman T. Rogers, Marcus B. Robinson and Thomas E. Lunger.

THE DOUGHTY & WELCH ELECTRIC COMPANY of Fall River, Mass., has been chartered with a capital stock of $50,000 to manufacture electrical appliances, etc. The incorporators are: W. H. Doughty, William T. Welch and M. D. Riley.

THE HARTFORD (CONN.) BATTERY MANUFACTURING COMPANY has been incorporated by Fred W. Barhoff of Hartford and S. P. Griswold of West Hartford. The company is capitalized at $200,000 and proposes to manufacture electric batteries.

THE RADISHAW MANUFACTURING COMPANY of New York, N. Y., has been incorporated by L. J. Haines, M. Ganya and J. Connors, 80 Broadway, New York, N. Y. The company is capitalized at $250,000 and proposes to manufacture telephones, etc.

THE PIERCETON (IND.) LIGHT & WATER COMPANY has been incorporated by J. T. Brosnahan, M. P. Kirkpatrick, G. A. Leifer, P. A. Ashley and J. L. Radcliff. The company is capitalized at $35,000 and proposes to supply water, light and power in Pierceton.

THE CANADIAN DRILL & ELECTRIC BOX COMPANY, LTD., of Ottawa, Can., has been incorporated by Frank J. Hughes, 72 Queen Street West; Leo J. Phelan, 12 Seaforth Avenue, Henry Catley and others. The company is capitalized at $100,000 and proposes to manufacture electrical supplies, etc.

THE T. J. CORCORAN LAMP COMPANY of Cincinnati, Ohio, has been incorporated with a capital stock of $400,000 to manufacture automobile lamps. The company has taken over the plant of the Corcoran Victor Company at Winton Place, which it will enlarge in the near future. T. J. Corcoran is president.

THE EUREKA POWER COMPANY of Eureka, N. S., Canada, has been incorporated by James O. Kerr and Thomas G. Grant of Eureka, Alexander McPhene of Windsor, N. S., and others. The company is capitalized at $100,000 and proposes to construct and operate electric light, heat and power plant and to manufacture electrical machinery, etc.

New England States

ST. ALBANS, VT.—The Public Service Commission has granted the Public Service Lighting Company of St. Albans permission to extend its electric transmission line to Burlington and through the highways of the city and to increase its capital stock by $50,000. These grants will make possible the completion of the transmission line between St. Albans and Fairfax and Burlington over which the company is to furnish electricity to the city for a period of ten years. The cost of the proposed line is estimated at $150,000, of which the power plant at Georgia will take about $80,000.

WEBSTER, MASS.—Contract has been awarded to Walter Stone of Webster for the new electric lighting units, etc., in connection with alterations and improvements to the Bartlett High School.

PROVIDENCE, R. I.—The City Council has granted the Narragansett Electric Lighting Company permission to erect a 66,000-volt transmission line from its power house across South and Points Streets.

WARREN, R. I.—The Narragansett Electric Lighting Company is erecting an outdoor substation at the power station of the New York, New Haven & Hartford Railroad Company off Main Street for the purpose of increasing the transmission service to Fall River and Bristol.

Middle Atlantic States

BATAVIA, N. Y.—The Genesee Light & Power Company has petitioned the Public Service Commission for permission to issue $220,000 in bonds. Part of the funds are to be used for refunding purposes and the remainder for extensions and improvements, which will include the erection of transmission lines to Attica and Le Roy, and also equipment for Attica to cost about $88,000.

CORNING, N. Y.—Arrangements, it is reported, are being made by the Corning Glass Company for the erection of a new power plant, 50 ft. by 80 ft., at its works. S. Firestone, Granite Building, Rochester, is engineer.

ELLENVILLE, N. Y.—The Ellenville Electric Company is contemplating extending its distribution lines (6 miles) in the Brigg Street district. G. C. Davis is engineer.

KINGSTON, N. Y.—The United Hudson Electric Corporation of New York has petitioned the Public Service Commission for permission to acquire the capital stock of the Kingston Gas & Electric Company, including the Ulster Electric Light, Heat & Power Company of Saugerties, and 775 shares of the Upper Hudson Electric & Railroad Company of Catskill. Authority is also asked to acquire the stock of the Rifton (N. Y.) Land Corporation and the development of two water-power sites on the Wallkill River at Dashville, one in the immediate future, with an estimated capacity of 50,000 hp., and also to acquire some transmission lines recently erected near Poughkeepsie, Newburgh and Kingston.

LONG ISLAND CITY, N. Y.—The Factory Construction Company of Brooklyn has been awarded general contract for the construction of a factory building, four stories, 90 ft. by 200 ft., on Nott Avenue east of the Boulevard in Long Island City, for Repetti, Inc., candy manufacturers. The cost of the building, exclusive of machinery and equipment, is estimated at $350,000. M. A. Cantor is architect.

MOUNT UPTON, N. Y.—The Public Service Commission has granted Messrs. Jewell and Rockwell of Guilford permission to construct an electric light plant to serve the Mount Upton lighting district.

POTSDAM, N. Y.—The St. Lawrence Transmission Company has increased its capital stock from $525,000 to $3,000,000, the proceeds to be used for extensions to its electric system.

UTICA, N. Y.—The Adirondack Electric Power Corporation, it is reported, is considering the erection of a new power plant in Utica. The company has recently completed its high-tension transmission line from Amsterdam to Utica.

NEWARK, N. J.—Plans have been filed by the American Oil & Supply Company, Lafayette Street, for a power plant, 40 ft. by 50 ft., to be erected at its proposed new works to be located on Wilson Avenue.

FARRELL, PA.—Plans are under consideration by the City Council for the installation of an ornamental street-lighting system on four thoroughfares. The cost is estimated at about $25,000. The Shenango Valley Electric Light Company furnishes electrical service in Farrell.

MONT ALTO, PA.—Extensive additions and improvements will be made to the State Sanitarium at Mont Alto during the coming season, including the installation of an electric light and power plant, the erection of a community house for recreation and amusement, a house for female help, etc. The cost is estimated at about $300,000.

PHILADELPHIA, PA. — Arrangements have been made by the Lester Piano Company for the installation of new electrical equipment in its plant, including a 500-kw., non-condensing, revolving-field, two phase, 60-cycle, 220-volt electric generating unit and other apparatus.

PITTSBURGH, PA.—The Pittsburgh Model Engine Company is planning to build a new plant in the Point Breeze section, to cost about $200,000. Two buildings will be erected, one two stories, 60 ft. by 320 ft., and the other one story, 40 ft. by 160 ft., to be equipped throughout with electrically operated machinery.

SAYRE, PA.—The Sayre Electric Company is extending its electric transmission to East Athens to furnish electrical service in that town.

WILLIAMSPORT, PA.—Plans are being prepared by the Citizens' Electric Company for the erection of a new one-story power plant, 60 ft. by 120 ft., in Williamsport, to cost with equipment about $250,000. J. Fischer is manager.

SMYRNA, DEL.—At a special election held recently the proposal to issue $35,000 in bonds for improvements to the water and light systems was carried.

MILLVILLE, W. VA.—The Northern Virginia Power Company has begun work on the extension to its local plant on the Shenandoah River. This power plant, it is said, will be connected with the Valley branch of the Baltimore & Ohio Railroad at Millville.

SOUTH CHARLESTON, W. VA.—Application has been made by the West Virginia Water & Electric Company of Charleston for a franchise to extend its electric transmission system through South Charleston.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent, Commissioners of the District of Columbia, Washington, D. C., until April 30 for furnishing 15,982 ft. telephone cable or signal cable for the electrical department.

WASHINGTON, D. C.—Bids will be received by the District Commissioners about June 1 for building foundation, power house and tunnel work in connection with the new Gallinger Municipal Hospital. The plans provide for twenty-one buildings, for which $500,000 has been appropriated.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 9 for a fire-alarm watchman's clock and low-voltage feeder systems in the Arlington Building, Washington. Plans and specifications at the above office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until April 29, South Brooklyn, N. Y., Schedule 7940½—one knife switch and one motor-generator with equipment. South Charleston, Schedule 7941½—two pumps with motors. Until May 2, Portsmouth, Schedule 7946½—three inclinable power presses and horning and wiring. Until May 6, Philadelphia, Pa., Mare Island, Cal., and Puget Sound, Wash, Schedule 7950½—52 direct-current voltmeters. Norfolk, Va., Schedule 7954½—induction motors. Until May 9, New Orleans, La., Schedule 7951½—two switchboards and spare parts. Application for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until April 29, Brooklyn, N. Y., Schedule 3913—miscellaneous interior communication cable; Schedule 3922—five combined ironers, steam-heated, electrically operated, roll 18 in. by 8 in.; sets of mechanical spare parts; sever return apron ironers, flat work, 48 or 50 by 16 in., 120 volts, direct current; sets mechanical spare parts, complete; Schedule 3914—miscellaneous solid, triple-braided, weatherproof wire. Washington, D. C., Schedule 3916—miscellaneous stranded, single-conductor wire. Pensacola, Fla., Schedule 3906—miscellaneous rubber-covered, braided, stranded copper wire. Philadelphia, Pa., Schedule 3906—plain, single-conductor lighting and power wire. Boston, Mass., Schedule 3918—four steam turbine-driven two stake, centrifugal gasoline pumps. Until May 6, South Brooklyn, N. Y., Schedule 3924—miscellaneous galvanized-steel conduit pipe. Application for proposals should designate the schedule desired by number.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central States

ALLIANCE, OHIO.—At an election held April 8 the proposal to issue $400,000 to establish a municipal electric light plant in Alliance was defeated.

ARCADIA, OHIO.—Bonds to the amount of $13,000 have been voted to provide funds to obtain electricity for the village.

CINCINNATI, OHIO.—Bids will be received by C. W. Handman, business manager of board of education, Cincinnati, until April 28 for electrical work in the Hoffman Public School on Woodburn Avenue. The cost of the building is estimated at $250,000.

CLEVELAND, OHIO.—The Van Dorn Electric Tool Company is planning to erect a new factory, 50 ft. by 100 ft., for its electrical department. New equipment, including dynamos, pumps, drills and lathes, to cost about $60,000, will be installed.

MIDDLETOWN, OHIO.—The Ohio Gas & Electric Company of Middletown has entered into contracts with the towns of Monroe and Jacksonboro to supply electricity in those municipalities. The company is also negotiating with other villages in this section to furnish electrical service.

NORWOOD, OHIO.—Bids will be rereceived by the board of education of Norwood until May 12 for electrical work in the new Allison Street school building. Harold Ryan is clerk.

TOLEDO, OHIO.—The Toledo Factories Company, Southard and Twelfth Streets, is contemplating the construction of a machine shop, to cost about $150,000. I. B. Hiett is president.

ZANESVILLE, OHIO.—The Baltimore Railroad Company, it is reported, is contemplating the construction of a shop in Zanesville, to be used principally for repairing electrical equipment.

LOUISVILLE, KY.—The directors of the Louisville Million-Dollar Factory Fund are considering the construction of a large factory building, which will probably be built in four units of 200,000 sq.ft. each. It will be ten stories high and will have a railroad connection. It will also be equipped with a central lighting and heating plant and a central shipping department. The elevators will be a part of the shipping department. The cost of the building is estimated at $1,600,000.

EAST ST. LOUIS, ILL.—Contract has been awarded by the East Side Packing Company to the Keeley Brothers Contracting Company for the construction of a factory and cold-storage building, to cost about $300,000.

PETERSBURG, ILL.—The Abbot Light & Power Company of Petersburg has been granted a certificate of convenience and necessity for the construction of a high-tension transmission line from Petersburg to Pleasant Plains. The company is also given authority to erect and operate a distribution system in the village of Pleasant Plains and to furnish electrical service to residents along the route.

QUINCY, ILL.—New machinery, including a motor generator, is being installed at the power house of the Quincy Railway Company to utilize power from the Keokuk plant. The steam-power plant will be held for use in emergencies.

ROSSVILLE, ILL.—The Rossville Electric Light Company has been granted a franchise by the Public Utilities Commission to erect a 6600-volt electric transmission line from Rosville to Alvin and to furnish electricity in Alvin and to residents along the line between the two towns.

ASHLAND, WIS.—The Ashland Dairy Products Company is planning to remodel the plant of the Ashland Brewing Company into a cold-storage warehouse, at a cost of about $75,000. New machinery, refrigerating and other equipment will be installed.

PRAIRIE DU CHIEN, WIS.—The Interstate Power Company of Galena, Ill., is erecting a high-tension transmission line across the Mississippi River at Prairie du Chien to McGregor, Iowa. This circuit will be supplied with power from the Galena power house. Among the Wisconsin towns to be served by the new system are Finnimore, Lancaster, Boscobel and Prairie du Chien. The Interstate company is controlled by the Northern States Power Company and operated by H. M. Byllesby & Company of Chicago, Ill.

OSHKOSH, WIS.—The Morgan Company is contemplating the construction of an addition to its power plant, including the installation of several new boilers and other equipment.

ANOKA, MINN.—The Legislature has appropriated $50,000 for completion of administration building and also $5,000 for electric wiring and water supply for farm building, the money to be available July 31, 1920.

BRAINERD, MINN.—Bids will be received until May 8 by the city of Brainerd for improvements to waterworks, including 14 miles of new water mains, six 8-in. tube wells, one open well, pumping station, equipped with electrically operated pumps, and a 300,000-gal. tank on a 90-ft. tower. The cost is estimated at about $250,000. L. P. Wolff, Guardian Life Building, St. Paul, is consulting engineer.

MINNEAPOLIS, MINN.—Plans are being prepared by Hewitt & Brown, architects, 716 Fourth Avenue, South, for an eleven-story exchange and office building for the Northwestern Telephone Exchange Company, to be erected on Third Avenue South and Fifth Street. The cost is estimated at about $1,000,000.

ST. PAUL, MINN.—Plans have been prepared for the erection of a hospital building and power plant at Simpson and Edmund Streets for the Northern Pacific Mutual Beneficial Association. Bids, it is understood, will be ready about May 1. Lambert Bassingdale, Railroad Building, is architect.

INDEPENDENCE, IOWA.—Contract has been awarded to the Currie-Simpson Construction Company of Waterloo for the construction of an addition to the power plant of the People's Hospital.

MARSHALLTOWN, IOWA.—A bill is before the Legislature asking for authority to extend the lines of the Iowa Railway & Light Company to the grounds of the Old Soldiers' Home.

CLARKSVILLE, MO.—The Clarksville Electric Light & Water Company, recently organized, has been granted a franchise, subject to the approval of the voters, to install an electric light and power plant here.

KANSAS CITY, MO.—The Park Board has petitioned for an appropriation of $100,000 for improvements to Swope Park. The plans provide for a complete lighting system.

ST. JOSEPH, MO.—Ordinances are being prepared by Charles L. Faust, city counselor, which will be submitted to the Council, providing for a bond issue of $1,810,000, for the following purposes: $500,000 for an electric light plant, $500,000 for a new city hall, $760,000 for sewers and $50,000 for motorization of the fire department.

ST. LOUIS, MO.—Contracts, it is reported, will soon be awarded by Swift & Company, Thirty-ninth and Papin Streets, for addition to power house, to cost about $70,000. H. A. Green is superintendent.

ST. LOUIS, MO.—Work, it is reported, has started on the construction of the power plant and the woodwork buildings for the proposed plant of the General Motors Company to be erected at Natural Bridge Avenue and Union Boulevard, at a cost of about $4,138,000.

FARGO, N. D.—Bonds to the amount of $150,000 have been voted to establish a municipal electric light plant in Fargo.

BEATRICE, NEB.—The construction of a hydroelectric power plant, to cost about $56,000, is under consideration by the City Council.

OMAHA, NEB.—Bids will be received by the Skinner Packing Company, First National Bank Building, Omaha, until May 15 for the erection of a cold-storage plant, to cost about $500,000.

KANSAS CITY, KAN.—The City Commissioners have authorized a special election to be held on June 17 to submit to the voters the proposal to issue $500,000 in bonds to enlarge the municipal electric light plant.

OTTAWA, KAN.—The City Commissioners have awarded contract for a 500-kw. electric generating unit at $27,760. Prof. George C. Shaad of Kansas University is consulting engineer.

ST. JOHN, KAN.—Bonds to the amount of $45,000 have been authorized for improvements to the municipal water and light plans.

SCRANTON, KAN.—Bonds to the amount of $12,000 have been voted to erect an electric transmission line from Burlingame to Scranton to supply electricity for the local system.

SEDAN, KAN.—The Sedan Electric Light & Power Company is considering extensions to its plants and system, including the erection of electric transmission lines to Peru, Chautauqua and Elgin and increasing the output of its power plant to provide for the proposed additional service. The installation of fuel-oil engines is contemplated. The cost of the work is estimated at $32,000.

TURNER, KAN.—The Standard Electric Company is planning to supply electricity for lamps and motors in Turner. For further information address J. J. Swigley of Turner.

Southern States

FAYETTEVILLE, N. C.—The Cumberland Railway & Power Company is building a 3000-hp. hydroelectric development at Fayetteville. Herbert L. Jones, 54 Haddington Block, Norfolk, Va., is president.

GREENVILLE, N. C.—Bonds to the amount of $50,000 have been authorized for improvements to the water and light plant.

WILSON, N. C.—The City Commission is considering issuing $75,000 in bonds for extensions to the municipal electric lighting system, including the purchase of additional equipment. R. J. Grantham is manager of the municipal plant.

CHATSWORTH, GA.—Steps have been taken to organize a company with a capital stock of $5[illegible]0 to establish a hosiery mill and electric plant here. The company will be capitalized at $50,000. Roy McGinty, J. G. Neely and others are interested.

SOUTHWEST LA GRANGE, GA.—At an election to be held April 30 the proposal to issue $25,000 in bonds for the installation of a municipal electric lighting system in Southwest La Grange will be submitted to the voters. Post office address is La Grange.

GAINESVILLE, FLA.—Bids will be received by the Board of Public Works, Gainesville, Fla., until May 6 for new equipment for the municipal electric light and waterworks plant, including crude-oil boilers of the steam atomizer type, with steam-driven oil pumping units and all necessary accessories for complete equipment of two Erie City water-tube boilers of 220 hp. each and a Stirling boiler of 240 hp.; also for two crude-oil storage tanks of 15,00 gal. capacity each. T. M. Early is superintendent.

MIAMI, FLA.—Extensions and improvements involving an expenditure of more than $200,000 are contemplated by the Miami Electric Light Company. New equipment, including a 3750-kw. generator, condenser, pumps and an additional boiler, twenty switchboards, etc., will be installed. The entire system will be changed from single-phase and two-phase to three-phase throughout. H. H. Hyman is manager.

CLARENDON, ARK.—The Commonwealth Power Company is contemplating the installation of an electric power plant in Clarendon.

HEBER SPRINGS, ARK.—The Arkansas Hydro-Electric Development Company is planning to resume work on construction of its hydroelectric plant on Little Red River near Heber Springs. Contract was to have been let in 1917, but was postponed owing to the war. The cost of the plant is estimated at $500,000. A. R. Amos of Heber Springs is president of the company.

PARIS, ARK.—The Harley Hardwood Company is planning to establish a new plant. Machinery and power equipment, costing about $50,000, will be required.

ARCADIA, LA.—Bids will be received by the Mayor and the Board of Aldermen of Arcadia until May 14 for improvements to the municipal electric light plant and waterworks system, including furnishing and installing alternators, switchboards, street-lighting regulator and miscellaneous line material for electric plant; for waterworks, erection of building, cast and galvanized iron pipe and fittings, valves and hydrants, oil engine, pumps, deep-well and air-lift system, reservoir, elevated tank and oil-storage facilities. Specifications, form of proposal, etc., may be obtained upon application to Xavier A. Kramer of Magnolia, Miss., engineer.

MARKSVILLE, LA.—Bids will be received by the Mayor and Board of Aldermen of Marksville until May 8 for improvements to the waterworks system, including oil-engine-driven pumping set, deep well, reservoir and elevated tank, cast-iron and galvanized pipe and fittings and fire hydrants. Plans and specifications, etc., may be obtained upon application to Xavier A. Kramer, engineer, Magnolia, Miss.

NORMAN, OKLA.—Bonds to the amount of $125,000 have been voted for the installation of an electric light and power plant in Norman.

TISHOMINGO, OKLA.—Bonds to the amount of $50,000 have been voted for the installation of a municipal electric light plant.

DALLAS, TEX.—The City Commission has approved of expenditures of approximately $500,000 by the Dallas Power & Light Company, which include the purchase of the properties of the Dallas Ice, Fuel, Light & Power Company and the Carroll Electric Company, both of which are to be taken over and merged into the system of the Dallas Power & Light Company.

FORT WORTH, TEX.—Bonds to the amount of $50,000 have been voted for extensions and improvements to the municipal electric lighting system.

HOUSTON, TEX.—The Humble Oil & Refining Company is planning to install an electric power plant and equipment for operating the pumping plants for its oil wells in the Goose Creek district. The proposed plant will also provide power for outside industries.

OAK FOREST, TEX.—The Houston-Guadalupe Water Power Company, Foster Building, Houston, recently organized with a capital stock of $200,000, is planning to build a hydroelectric plant to develop 500 hp. The cost is estimated at $500,000. H. A. Halverton is interested in the project.

Pacific and Mountain States

CHEHALIS, WASH.—At a special election held recently the proposal to grant the Washington-Idaho Light & Power Company of Clarkston a franchise to supply electricity in Chehalis was carried.

BRAWLEY, CAL.—The Board of City Trustees has engaged the Olmstead & Gillilen Company, engineers, Los Angeles, to prepare plans and supervise the construction of the proposed municipal electric light plant. It is proposed to install two units of 250 kw. each. The minimum cost is placed at $116,000.

CALEXICO, CAL.—The City Trustees have adopted a resolution providing for establishing electric and gas plants in Calexico. The cost of the electric plant is estimated at $160,000 and the gas plant at $165,000.

FRESNO, CAL.—The California Packing Corporation of Fresno is planning to erect an electric power plant in connection with its new factories. The proposed plant will be equipped with mechanical and electrical equipment, including automatic machinery for handling and packing. Philip Bush, 101 California Street, San Francisco, is engineer.

LOS ANGELES, CAL.—The installation of an ornamental lighting system on Westmoreland Place between Seventh Street and Wilshire Boulevard has been authorized by the City Council.

ORLAND, CAL.—The installation of an ornamental lighting system in the business district is under consideration.

SACRAMENTO, CAL.—A bill which provides that irrigation districts may utilize water used for irrigation purposes to develop electrical power has been passed by the State Legislature.

CEDAR CITY, UTAH.—The City Council is negotiating with the Dixie Power Company to remove its electric poles from the main street into the block centers.

SALT LAKE CITY, UTAH.—Improvements to the waterworks supply lines, power plants, etc., to cost about $1,000,000, are contemplated by the City Council.

Canada

CLOVERDALE, B. C.—The British Columbia Electric Company is planning to extend its transmission lines to Surrey Centre to furnish electricity for lamps and motors there.

(Issued March 25, 1919)

1,298,622. MEANS FOR SYNCHRONIZING ROTARY DEVICES; George M. Yorks, New York, N. Y. App. filed Jan. 5, 1915. Separate divisions of commutators, for effecting synchronization are dispensed with.

1,298,623. ELECTRIC ATTACHMENT PLUG; Carl Zeigler, Lewiston, Me. App. filed Oct. 20, 1917.

1,298,624. IGNITION DYNAMO; James G. Zimmerman, Sumter, S. C. App. filed May 12, 1916. Produces two simultaneous sparks and may be used on two-cylinder engine having cylinders 180 deg. apart.

1,298,627. RESISTANCE ELEMENT; Theodore W. Case, Scipio, N. Y. App. filed Feb. 19, 1917. Interposed in electric circuit for exposure to light rays.

(Issued April 1, 1919)

1,298,644. MANUFACTURE OF ELECTRIC CABLES; Charles J. Beaver and Ernest A. Claremont, Chester, Eng. App. filed April 4, 1918. Twin wires insulated from one another and inclosed within small space.

1,298,649. SYSTEM AND MEANS FOR DIFFERENTIALLY METERING ELECTRICITY FOR LIGHTING AND HEATING PURPOSES; Lawrence Birks and John R. Templin, Fendalton, Christchurch, New Zealand. App. filed July 8, 1916. Records directly all current supplied under special differential rates.

1,298,654. FUSE PLUG; Davis E. Bown, Pittsburgh, Pa. App. filed April 25, 1918. Renewable type; upper edge of shell is serrated.

1,298,664. VACUUM PUMP; Lewis W. Chubb, Edgewood Park, Pa. App. filed Jan. 18, 1915. Moves electrically conducting liquids by the effect of moving magnetic field.

1,298,665. TERTIARY COILS FOR TRANSFORMERS; Lewis W. Chubb, Edgewood Park, Pa. App. filed Jan. 26, 1917. Effectively operates under all load conditions.

1,298,695. DAMPING DEVICE FOR DYNAMO-ELECTRIC MACHINES; Floyd T. Hague, Pittsburgh, Pa. App. filed Dec. 29, 1915. Damps out fluctuations in armature flux under interpoles.

1,298,696. SYSTEM OF CONTROL; Arthur J. Hall, Wilkinsburg, Pa. App. filed Jan. 4, 1916. Regenerative type for plurality of direct-current electric railway motors.

1,298,701. MAGNETIC DEVICE; Clinton O. Harrington, Edgewood Borough, Pa. App. filed June 13, 1916. For relays.

1,298,704. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed April 29, 1915. Independently excited alternating-current commutating machines with direct-current series-machine characteristics.

1,298,705. ARMATURE WINDING; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed June 4, 1915. Single-phase commutator type with small inductive disturbances.

1,298,706. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Aug. 9, 1915. For regenerative operation in electric railway vehicles.

1,298,707. ELECTRICAL APPARATUS; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Dec. 26, 1913. Reduces brush sparking.

1,298,710. BURGLAR-ALARM SYSTEM; Simon B. Hess, New York, N. Y. App. filed May 17, 1915. Accidental breaking of any of a plurality of normally closed currents gives an alarm.

1,298,711. ELECTRIC DISTRIBUTION SYSTEM; Simon B. Hess, New York, N. Y. App. filed May 17, 1915. Public service or other electric mains utilized for protective or other work circuits, eliminating use of batteries.

1,298,712. CONTROL SYSTEM; Lloyd J. Hibbard, Wilkinsburg, Pa. App. filed March 2, 1917. Motors of railway vehicle quickly reversed in case of emergency.

1,298,715. ARC-REGULATING SYSTEM; Harry Hollis, Lebanon, Pa. App. filed Sept. 10, 1917. Electric furnaces are controlled by differential generator field-magnet windings.

1,298,718. MACHINE FOR METAL WORKING; William F. Hosford, Oak Park, Ill. App. filed Nov. 27, 1916. Metal is automatically fed, cut, heated and formed.

1,298,722. METHOD OF REFINING VOLATILE METALS; Sven Huldt, Stockholm, Sweden. App. filed Aug. 7, 1916. Zinc vapors exhausted for condensation in electric radiating furnace.

1,298,726. RECTIFIER; Ray P. Jackson, Edgewood Park, Pa. App. filed Feb. 19, 1914. Magnetic blow-out type.

Record of Electrical Patents

Notes on United States Patents

1,298,727. VIBRATING RECTIFIER; Ray P. Jackson, Edgewood Park, Pa. App. filed March 25, 1914. Needs no permanent uni-directional exciting current.

1,298,728. ELECTRICAL SYSTEM; Ray P. Jackson, Edgewood Park, Pa. App. filed Feb. 3, 1916. Current through primary circuits of ignition systems is periodically reversed.

1,298,736. CIRCUIT BREAKER; Jean Kuntziger, Herman Chauvin and Felix Fontaine, Liège, Belgium. App. filed Sept. 7, 1916. Decrease in tensile strength of wire effects rupture of circuits.

1,298,746. ELECTRICALLY OPERATED SWITCH; Walter O. Lum, Wilkinsburg, Pa. App. filed March 21, 1914. Operates when energy supplied to winding falls between predetermined limits.

1,298,757. DYNAMO-ELECTRIC MACHINE; Friedrich W. Myer, Pittsburgh, Pa. App. filed March 24, 1915. Electromagnetic yielding clutch provided between shaft and armature of electric locomotive motor.

1,298,770. ELECTRIC FIXTURE; Edmund F. Mould, Cleveland, Ohio. App. filed Aug. 12, 1915. Uses gas-filled lamps and provides for efficient heat radiation.

1,298,771. TELEPHONE HANDSET; George H. Nash, Sidcup, Eng. App. filed July 2, 1917. Folded up when not in use.

1,298,774. SYSTEM OF STARTING PHASE CONVERTERS; Stanley G. Nottage, Wilkinsburg, Pa. App. filed Jan. 5, 1916. Reduces possibility of burn-out during starting.

1,298,795. SPARK TESTER; Frederick A. Robens, Toledo, Ohio. App. filed Aug. 2, 1918.

1,298,818. CONTROL SYSTEM; Norman W. Storer, Pittsburgh, Pa. App. filed April 23, 1915. For electric railway motors regeneratively connected to supply circuit.

1,298,829. BRUSH GEAR FOR DYNAMO-ELECTRIC MACHINES; James Todman, Acton, Eng. App. filed Oct. 15, 1918. Readily applied and removed.

1,298,850. TELEPHONE-EXCHANGE SYSTEM; Joseph L. Wright, Cleveland, Ohio. App. filed May 7, 1913. Semi-automatic type.

1,298,854. LIGHTING SWITCH; Forrest E. Altemus, Philadelphia, Pa. App. filed Oct. 28, 1915. For automobile lights.

1,298,856. BATTERY SEAL; Chester M. Angell, Chicago, Ill. App. filed Nov. 12, 1918. Acid-resisting, non-freezing nut cuts its own thread upon post.

1,298,857. BATTERY; Chester M. Angell, Chicago, Ill. App. filed Jan. 3, 1919. Additional supports provided for plates to withstand heavy jolts.

1,298,858. CONNECTOR; Stanley Anthony, Boston, Mass. App. filed March 10, 1915. Contact elements and locking elements are not exposed.

1,298,864. ELECTRICALLY OPERATED MUSICAL INSTRUMENT; Daniel W. Barton, Oshkosh, Wis. App. filed Sept. 16, 1916.

1,298,868. TELEGRAPH SYSTEM; John H. Bell, East Orange, N. J. App. filed May 16, 1916. Receiving operator can interrupt sending operator.

1,298,871. INDICATING DEVICE; Bornett L. Bobroff, Milwaukee, Wis. App. filed June 16, 1917. For voting machine.

1,298,879. ELECTRIC CONNECTION; William H. Brown, Philadelphia, Pa. App. filed Dec. 13, 1917. Forms protection from water, heat, dirt, etc.

1,298,889. METHOD AND APPARATUS FOR THE OXIDATION OF COMBUSTIBLE GASES; Edwin M. Chance, Wilkes-Barre, Pa. App. filed Aug. 14, 1917.

1,298,896. SPARK-PLUG TESTER; Walter G. Clink, Danville, Ill. App. filed March 26, 1917.

1,298,943. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed May 4, 1915. For generative operation of direct-current motors in electric railway vehicles.

1,298,950. CIRCUIT CLOSER; George E. Hull, Minneapolis, Minn. App. filed Dec. 4, 1918. Actuates by gravity.

1,298,965. METHOD OF APPLYING INSULATED PIECES TO CARBON BRUSHES; Cecil Y. Knight and William N. Wilson, Battersea, London, Eng. App. filed Nov. 30, 1918. Applied as plastic composition.

1,298,966. ELECTRICALLY OPERATED TOOL; James S. Knowlson, Oak Park, Ill. App. filed June 16, 1915. Electromagnet supplied with direct-current by motor-driven generator of low voltage.

1,298,974. METHOD AND MEANS FOR CONTROLLING ELECTRIC ENERGY; H. Ward Leonard, Bronxville, N. Y. App. filed July 22, 1914. After full voltage is obtained, charging rate is reduced.

1,299,008. HAIR-WAVING DEVICE; August Neyer, San Francisco, Cal. App. filed Aug. 13, 1918.

1,299,042. FIXTURE; Lindsley Schepmoes, Hasbrouck Heights, N. J. App. filed Nov. 3, 1916. Junction box supports lamps and pendants of all kinds.

1,299,053. DYNAMO-ELECTRIC MACHINE; Albert A. E. Sterzing, New York, N. Y. App. filed March 25, 1914. Field magnet of magnet-electric induction type without polar fittings.

1,299,090. PUNCHED-CARD-CONTROLLED MECHANISM; John E. Wright, New York, N. Y. App. filed April 25, 1917.

1,299,110. ELECTRIC FURNACE; William K. Booth, Chicago, Ill. App. filed April 4, 1918. Equipped with wall terminals adapted to coact with electrodes.

1,299,116. CLOCK-WINDING MECHANISM; James W. Bryce, Bloomfield, N. J. App. filed July 31, 1917.

1,299,119. NON-GROUNDED OR METALLIC LINE-CIRCUIT SYSTEM; Raymond H. Burfeind, Chicago, Ill. App. filed April 18, 1907. Automatic telephone systems.

1,299,132. RENEWABLE FUSE; Franklin N. Conant, Newburyport, Mass. App. filed March 9, 1918. Cartridge type, having knife-blade contact blades.

1,299,144. ELECTRICALLY CONTROLLED PNEUMATIC BRAKE; Edward H. Dewson, New York, N. Y. App. filed June 1, 1916. For railway systems.

1,299,147. CIRCUIT-CONTINUING DEVICE; Harry A. Douglas, Bronson, Mich. App. filed July 23, 1917. Connecting plug.

1,299,149. BATTERY TERMINAL; Stanley A. Duvall, Chicago, Ill. App. filed Sept. 21, 1918. Flexible conductor for portable primary batteries.

1,299,152. TROLLEY HARP; Albert J. Edwards, Washington, D. C. App. filed July 12, 1917. Trolley-wheel connection locked immovably with harp.

1,299,155. CIRCUIT FOR POLE CHANGERS; Charles J. Erickson, Chicago, Ill. App. filed June 11, 1917. Pole changer may be operated from common exchange battery.

1,299,159. ELECTRICAL WATER HEATER; Joseph C. Feldman, New York, N. Y. App. filed Sept. 23, 1918.

1,299,163. TWO-TONED AUTOMOBILE-HORN CONTROL; George W. Fleming, Springfield, Mass. App. filed April 27, 1918.

1,299,213. AUTOMATIC CABLE-HANGER DISTRIBUTER; William Nick, Minneapolis, Minn. App. filed May 16, 1918. For crimping cable hangers onto a messenger strand.

1,299,248. MOTOR CONTROLLER; Arthur Simon, Milwaukee, Wis. App. filed May 20, 1914. Maintains continuity of motor circuit during regulation of potential.

1,299,252. MEASURING DEVICE; Joseph Slepian, Pittsburgh, Pa. App. filed April 4, 1918. Current-measuring instrument for high-voltage direct-current circuits without current shunt.

1,299,257. GEAR-SHIFT CONTROLLER; William C. Stevens, Milwaukee, Wis. App. filed July 25, 1918. May be ultilized for both gear-shift and ignition control.

1,299,265. ZIGZAG CARBON ELECTRIC REGISTER; John Thomson, New York, N. Y. App. filed May 28, 1918. Large capacity of thermal emission.

1,299,269. ELECTROPNEUMATIC BRAKE; Walter V. Turner, Wilkinsburg, Pa. App. filed May 4, 1918. Quick release of brakes effected after emergency application.

1,299,271. ATTACHMENT PLUG; Clarence A. Vetter, Pittsburgh, Pa. App. filed April 10, 1915. Swivel type which has no loose parts.

1,299,280. ELECTRICAL CONDUIT; Chauncey W. Abbott, Pittsburgh, Pa. App. filed April 17, 1915. Edges of resilient metal cap can be readily sprung over edges of base member.